EPA/ROD/R01-99/104
1999

EPA Superfund
Record of Decision:

OTIS AIR NATIONAL GUARD BASE/CAMP EDWARDS
EPA ID: MA2570024487
OU 08
FALMOUTH, MA
08/16/1999

Massachusetts Military Reservation

RECORD OF DECISION
AREA OF CONTAMINATION CS-10/FS-24
SOURCE AREAS

FINAL

July 1999

Prepared for:
AFCEE/MMR
Installation Restoration Program
322 E. Inner Road, Box 41
Otis ANGM, MA 02542
DSA: 557-4670 COMM:508-968-4670

Submitted by
HAZARDOUS WASTE REMEDIAL ACTION PROGRAM
Oak Ridge, Tennessee 37831-7606
Managed by
LOCKHEED MARTIN ENERGY SYSTEMS
for the
U.S. DEPARTMENT OF ENERGY
under contract DE-AC05OR21400

RECORD OF DECISION
AREA OF CONTAMINATION CS-10/FS-24
SOURCE AREAS

MASSACHUSETTS MILITARY RESERVATION
CAPE COD, MASSACHUSETTS

FINAL

JULY 1999

Intentional Blank Page

CONTENTS

Intentional Blank Page

LIST OF FIGURES

LIST OF TABLES

Intentional Blank Page

ACRONYMS AND ABBREVIATIONS

ABB-ES	ABB Environmental Services, Inc.
AFCEE	Air Force Center for Environmental Excellence
AOC	Area of Contamination
ARAR	applicable or relevant and appropriate requirement
ARNG	Army National Guard
ASG	Automated Sciences Group, Inc.
ATSDR	Agency for Toxic Substances and Disease Registry
AWQC	Ambient Water Quality Criteria
bgs	below ground surface
BOMARC	Boeing-Michigan Aeronautical Research Center
CDM Federal	CDM Federal Programs Corporation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	*Code of Federal Regulations*
CMR	*Code of Massachusetts Regulations*
COC	contaminant of concern
CS	chemical spill
CSF	cancer slope factor
CWA	Clean Water Act
cy	cubic yard
DCE	1,2-dichloroethylene
DOD	Department of Defense
DSRP	Drainage Structure Removal Program
ER-L	effects range-low
ER-M	effects range-medium
FFA	Federal Facility Agreement
FFS	Focused Feasibility Study
FS	Fuel Spill
HAZWRAP	Hazardous Waste Remedial Actions Program
HEC	health/risk equivalent concentration
HI	Hazard Index
HQ	Hazard Quotient
IRP	Installation Restoration Program
K_{oc}	water organic-carbon partition coefficient
MADEP	Massachusetts Department of Environmental Protection

MCL	Maximum Contaminant Level
MCP	Massachusetts Contingency Plan
MMR	Massachusetts Military Reservation
µg/g	micrograms per gram
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NGB	National Guard Bureau
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
O&M	operation and maintenance
PAH	polynuclear aromatic hydrocarbon
PAT	Process Action Team
PAVE PAWS	Precision Acquisition Vehicle Entry - Phased Array Warning System
PCB	polychlorinated biphenyl
PCE	tetrachloroethylene
ppb	parts per billion
ppm	parts per million
PRA	Preliminary Risk Assessment
RAH	Risk Assessment Handbook
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
RI	Remedial Investigation
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act of 1986
SI	Site Investigation
SQC	sediment quality criteria
SQG	Sediment Quality Guidelines
STCL	soil target cleanup level
SVE	soil vapor extraction
SVOC	semivolatile organic compound
TCA	trichloroethane
TCE	trichloroethylene
TCLP	Toxicity Characteristic Leaching Procedure
TEAC	Technical Environmental Affairs Committee
TPH	total petroleum hydrocarbons
TSDF	treatment, storage, and disposal facility
USAF	U.S. Air Force

USC	United States Code
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
UTES	Unit Training Equipment Site
VOC	volatile organic compound

Intentional Blank Page

1. DECLARATION

1.1 SITE NAME AND LOCATION

Area of Contamination
CS-10/FS-24 Source Areas
Otis Air National Guard [U.S. Air Force (USAF)]
Falmouth, Massachusetts

1.2 STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) presents the Air Force Center for Environmental Excellence's (AFCEE's) selected remedial actions for contaminant source areas at the following Area of Contamination (AOC) at the Massachusetts Military Reservation (MMR) in Barnstable County on Cape Cod, Massachusetts:

- Chemical Spill No. 10 (CS-10)
- Fuel Spill No.24 (FS-24)

These remedial actions were developed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA), 42 *U.S. Code* (USC) §§ 9601 et seq. and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) at 40 *Code of Federal Regulations* (CFR) Part 300. The director, AFCEE, and the director of the Office of Site Remediation and Restoration, U.S. Environmental Protection Agency (USEPA) New England have been delegated the authority to approve this ROD.

This ROD is based on the Administrative Record for AOC CS-10/FS-24 that has been developed in accordance with Section 113(k) of CERCLA. The Administrative Record is available for public review at the AFCEE Installation Restoration Program (IRP) Office at MMR and at the Falmouth Public Library, Falmouth, Massachusetts.

The Commonwealth of Massachusetts concurs with the selected remedies for AOC CS-10/FS-24. Appendix E of this ROD contains a copy of the letter of concurrence.

1.3 ASSESSMENT OF AOC CS-10/FS-24

Actual or threatened releases of hazardous substances from the AOC CS- IO/FS-24 source areas, if not addressed by implementing the response action selected in this ROD, may present a current or potential threat to public health, welfare, or the environment.

1.4 DESCRIPTION OF THE SELECTED REMEDY FOR AOC CS-10/FS-24

Six areas within CS- IO/FS-24 have been identified as requiring remediation based on identified human health and ecological risks. Three additional areas have also been recommended for remediation based on soil contamination above MMR risk-based and leaching-based Soil Target Cleanup Levels (STCLs). These nine source areas have been designated Details A through 1.

Contaminants of concern (COCs) identified for remediation at CS-10/FS-24 in this source control action are volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), inorganics, and total petroleum hydrocarbons (TPH) compounds. The COCs identified for each Detail are presented in Table 1-1.

The selected remedy for the source areas at AOC CS- 10/FS-24 is Excavation, On-site Asphalt Batching and Off-site Disposal/In Situ Thermally Enhanced Soil Vapor Extraction/Environmental Monitoring. This remedial action is a source control action designed to address the two principal threats at AOC CS-10/FS-24: (1) exposure of human and ecological receptors to surface soil, sediment, and surface water and (2) exposure to contaminated groundwater resulting from potential leaching of VOCs, SVOCs, pesticides, PCBs, inorganics, and TPH compounds into groundwater. Although groundwater exposure is not specifically addressed as an exposure pathway for this source control action, groundwater exposure is relevant on a larger scale because potential downgradient receptors may be exposed to COCs in groundwater from a number of possible sources, including AOC CS-10/FS-24. As a result, groundwater is being addressed as a separate groundwater operable unit (CS-10D) in *UTES/BOMARC and BOMARC Area Fuel Spill, AOC CS-10 Groundwater Operable Unit: CS-10D and Hydrogeologic Region II Study* (CDM Federal 1996). To support possible remedial actions for the CS-10D groundwater operable unit, this source control action is also designed to ensure that surface soil and sediment COCs do not present a potential for groundwater exposure to human receptors from the leaching of soil and sediment contaminants into underlying groundwater. Therefore, soil and sediment cleanup levels protective of groundwater (i.e., soil leaching criteria) were also considered in selecting cleanup levels at AOC CS-10/FS-24.

This selected remedial action consists of removal of contaminated surface water from the Detail F drainage impoundment for disposal at the base wastewater treatment plant or an off-site treatment plant; excavation of contaminated surface soils and sediments from seven of the nine source areas (Details A through F, and I); on-site cold-mix asphalt batching of recyclable excavated surface soils and sediments; and off-site disposal of non-recyclable excavated surface soils and sediments. Also included is the design, construction, and operation of a thermally enhanced soil vapor extraction (SVE) treatment system to clean up deeper soils at Detail C; sampling and analysis of soils at Details G and H to confirm findings that there are no COCs in exceedance of STCLs at those two source areas; post-excavation confirmation sampling to ensure that all surface soils and sediments with

COC concentrations exceeding STCLs are removed; implementation and maintenance of access restrictions; and 5-year reviews of remedy protectiveness at all AOC CS-10/FS-24 source areas. The remedy addresses the principal threats by reducing the mobility and volume of contaminated soils and sediment such that human health and ecological risks do not exceed federal and state risk management guidelines designed to protect human health and the environment. If sampling indicates that COC concentrations are below STCLs at Details G or H, then no further action will be performed at that source area; if COC concentrations are found to exceed STCLs, then further action will be recommended. In addition, as part of the remedial design, it will be determined whether additional remedial action is warranted with regard to the Building 4606 drainage structures, including but not limited to removal of the drainage structures and all contaminated liquids in the structures, an investigation to determine the source of contamination in the structures and characterize any soil contamination associated with the structures, and excavation and/or treatment of any contaminated soils.

Major components of the selected remedy include the following.

Component 1—Excavation, On-site Asphalt Batching and Off-site Disposal

- Mobilization and site preparation.
- Removing contaminated surface water for Detail F drainage impoundment for disposal at the base wastewater treatment plant or an off-site treatment plant.
- Excavating surface soils and sediment with contaminant concentrations exceeding STCLs at seven source areas (Details A through F and I).
- Collecting post-excavation confirmation samples to ensure that all surface soils and sediments with COC concentrations exceeding STCLs are removed.
- Transporting excavated soils and sediments that are determined to be below Resource Conservation and Recovery Act (RCRA) Toxicity Characteristic Leaching Procedure (TCLP) (40 CFR 261.24) allowable concentrations and to contain contaminant concentrations below Massachusetts Department of Environmental Protection (MADEP) Massachusetts Contingency Plan (MCP) Method 1 S-1/GW-1 Standards for pesticides and Massachusetts Permitted Soil Recycling Facility Summary Levels to an on-site asphalt-batching facility for treatment.
- Transporting excavated soils and sediments that are determined to be above RCRA TCLP allowable concentrations or to contain concentrations above MADEP MCP Method 1 S1/GW-1 Standards for pesticides or Massachusetts Permitted Soil Recycling Facility Summary Levels at a RCRA Subtitle C treatment, storage, and disposal facility (TSDF) for off-site disposal.
- Backfilling and restoring excavations with clean borrow material.
- Using the asphalt-emulsion-coated product as a paving subgrade material at selected locations at MMR.

Component 2—In Situ Thermally Enhanced Soil Vapor Extraction

In situ SVE at one source area (Detail C) to treat contamination in soils from 0 to 30 feet below ground surface (bgs) until concentrations below STCLs are attained.

Component 3---Environmental Monitoring

- Environmental sampling at two source areas (Details G and H).
- If sampling indicates that COC concentrations at Detail G or H are below STCLs, then no further action will be recommended.
- Groundwater monitoring at all AOC CS-10/FS-24 source areas.
- 5-year review at all AOC CS-10/FS-24 source areas.

1.5 STATUTORY DETERMINATIONS FOR AOC CS-10/FS-24

The selected remedy is consistent with CERCLA and, to the extent practicable, the NCP; is protective of human health and the environment; complies with federal and more stringent Commonwealth of Massachusetts requirements that are legally applicable or relevant and appropriate to the remedial action; and is cost-effective. The remedy uses permanent solutions and alternative treatment technologies to the maximum extent practicable. In addition, the remedy satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduces the toxicity, mobility, or volume of materials comprising the principal threats through treatment).

Because this remedy will result in hazardous substances remaining on-site above levels that allow for unlimited use and unrestricted exposure, a review will be conducted within 5 years after initiation of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment.

1.6 SIGNATURE AND SUPPORT AGENCY ACCEPTANCE OF THE REMEDY

Concur and recommend for immediate implementation:

AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE

29 JUL 1999

Gary M. Erickson, P.E.
Director

Date

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

August 16, 1999

Patricia L. Meaney
Director, Office of Site Remediation and Restoration
U.S. Environmental Protection Agency, New England

Date

Intentionally Blank Page

2. DECISION SUMMARY

2.1 SITE NAME, LOCATION, AND DESCRIPTION

This ROD addresses past releases of contaminants to soil, sediment, and surface water at the following AOC at MMR on Cape Cod, Massachusetts:

- Chemical Spill No. 10 (CS-10)
- Fuel Spill No. 24 (FS-24)

Groundwater contamination associated with this AOC is being addressed as part of the *UTES/BOMARC and BOMARC Area Fuel Spill, AOC CS-10 Groundwater Operable Unit: CS-10D and Hydrogeologic Region II Study* (CDM Federal 1996). Actions implemented as a result of this ROD will support future groundwater remedial actions by minimizing future groundwater contamination.

MMR is located on western Cape Cod in Barnstable County, Massachusetts, approximately 60 miles south of Boston and immediately southeast of the Cape Cod Canal (Figure 2-1, Appendix A). It occupies approximately 22,000 acres within the towns of Bourne, Falmouth, Mashpee, and Sandwich. AOC CS-10/FS-24 occupies approximately 38 acres at the northeastern boundary of MMR (Figure 2-2, Appendix A).

MMR is organized into four principal functional areas.

- Cantonment Area. Occupying 5,000 acres in the southern portion of MMR, this area is the location of administrative, operational, maintenance, housing, and support facilities for the base. This is the most actively used section of MMR. The Otis Air Force Base facilities, including the flight line area, are located in the southeast portion of the Cantonment Area.

- Range Maneuver and Impact Area. This 14,000-acre area occupies the northern 70% of MMR and is used for training and maneuvers. AOC CS-10/FS-24 is located near the southeast corner of this area.

- Massachusetts National Cemetery. This area consists of 750 acres along the western edge of MMR and contains the Veterans Administration cemetery and support facilities.

- Cape Cod Air Force Station. This area occupies 87 acres of the northern portion of the Range Maneuver and Impact Area and is known as the Precision Acquisition Vehicle Entry Phased Array Warning System (PAVE PAWS).

MMR is a National Priorities List (NPL) site under CERCLA. Private sector sites placed on the NPL are eligible to receive funding for cleanup from the nations environmental trust fund (i.e., Superfund). Federal military facilities such as MMR receive funding from the Department of Defense (DOD). AOC CS- 10/FS-24 is considered a subsite to the entire NPL site.

AOC CS-10/FS-24 is located adjacent to the northeastern boundary of MMR, geographically within the boundary of the Town of Sandwich, Massachusetts, immediately north of the MMR Sandwich Gate on Greenway Road (Figure 2-2). AOC CS-10/FS-24 occupies approximately 38 acres (mostly fenced) and consists of a number of buildings originally constructed as part of the Boeing-Michigan Aeronautical Research Center (BOMARC) site by the USAF. The site is currently used by the Air National Guard (ANG) as the Unit Training Equipment Site (UTES) facility for maintenance and storage of vehicles. Approximately 25 Army National Guard (ANRG) personnel currently work at the AOC as part of the UTES operations. Most of AOC CS-10/FS-24 is fenced with a 7-foot-high chain-link security fence topped with barbed wire, restricting site access. Former missile launcher shelters are located within CS-10B along with a subsurface utility corridor connecting the shelters (utilidor system). Former missile maintenance and support facilities are located within CS-10A. Exposure of UTES personnel to site source area contamination is not known to occur.

Surface soils at AOC CS-10/FS-24 are composed of fill or reworked material in many areas of CS-10A and CS-10B. Test pits in CS-10A revealed compacted silty material near the surface overlying looser, poorly graded sands at depth. A 0.5-foot-thick layer of gray clay or gray clay and fine sand was identified in test pits (TP-23 through TP-28) excavated in the northeastem corner of CS-10A at depths ranging from 2 to 6 feet bgs. The presence of compacted silty fill and lenses of silty or clayey material is probably intermittent but could serve to locally impede downward migration of surface spills.

Subsurface soils (less than 100 feet bgs) for all of CS-10/FS-24 are typical of the Mashpee Pitted Plain geologic unit, which consists of fine- to coarse-grained sands. Subsurface soils encountered at CS-10/FS-24 are predominantly poorly graded, fine- to medium-grained sand with trace amounts of coarse sand, fine-to-coarse gravel, cobbles, and silt. A composite soil sample from boring MW-3 (0 to 16 feet bgs) was composed of approximately 15% gravel, 5% coarse sand, 75% fine-to-medium sand, and 5% silt.

The depth to groundwater at the AOC CS-10/FS-24 is approximately 85 feet bgs at an elevation of approximately 65 feet. Groundwater flows southwesterly across the CS-10/FS-24 site. Horizontal gradients are in the range of 5×10^{-4} feet per foot throughout the year. Vertical gradients are low and vary from approximately 7.5×10^{-3} feet/foot upward to 4.6×10^{-3} feet/foot downward. Generally, the vertical gradients are similar to or less than the horizontal gradient in the aquifer and are not expected to locally result in significant vertical flow as compared to horizontal flow. Hydraulic conductivity at CS-10/FS-24 ranges from 90 to 211 feet per day averaging 167 feet day.

Several storm drains from the site discharge surface water runoff to a drainage retention basin referred to as the Eastern Drainage Impoundment. This impoundment is a man-made depression designed as a retention area to allow surface runoff to infiltrate to the groundwater and is constructed as part of the BOMARC facilities. The bottom of the impoundment is at an elevation of approximately 140 feet, approximately 75 feet above the regional water table. Due to poor maintenance over the years, the bottom of the retention area appears to have silted in, resulting in the presence of standing water (approximately 60 feet by 75 feet and 1 to 2 feet deep) and wetland vegetation. The impoundment is shown on the Pocasset Quadrangle of the National Wetland Inventory Maps (U.S. Fish and Wildlife Service 1997) as a palustrine open water wetland of unknown depth that is seasonally flooded/semipermanent (designated POWZ). A pipe connects the impoundment to a drainage ditch running from the base through residential property emptying into Weeks Pond. In 1998, pipe was sealed from the on-based side and plans are underway to seal the other side in the near future.

Two significant features located outside the fence are the Southern Outfall Drainage Ditch and the waste oil disposal site. A single storm drain discharges water to the Southern Outfall Drainage Ditch (approximately 200 feet long, 5 feet wide at the bottom, and 5 feet deep). The waste oil disposal site consists of two patches of oil-stained soil located approximately 150 feet north of the CS-10/FS-24 fence in a clearing in the woods.

The nearest MMR housing is located approximately 19,000 feet southwest of AOC CS-10/FS-24. The nearest off-MMR housing area is located in the Town of Sandwich, with the closest home located approximately 100 feet from the Eastern Drainage Impoundment (Area F) at CS-10/FS-24. These homes are all served by public water supply. The only homes on private wells in this area are located to the northeast of CS-10/FS-24 in the Arnold Road/Raccoon Lane area. Approximately 75 households are located within 0.5 mile of AOC CS-10/FS-24 outside the MMR boundary and to the east in the town of Sandwich.

A more complete description of MMR and this AOC can be found in the *Phase I*: *Records Search* (E.C. Jordan 1986) and in the *Remedial Investigation* (*RI UTES/BOMARC and BOMARC Area Fuel Spill (AOC CS-10 and AOC FS-24) Source Operable Units* (CDM Federal 1997). These reports are available for review at the main libraries in the towns of Bourne, Falmouth, Mashpee, and Sandwich, and at the U.S. Coast Guard library at MMR.

2.2 SITE HISTORY AND ENFORCEMENT ACTIVITIES

This section provides background information on the site's history and enforcement actions taken to date. Factors addressed include the land use and site history of activities at the site, the history of site investigations (SIs), and the history of CERCLA enforcement activities.

2.2.1 Land Use And Site History

Although military activity began at MMR as early as 1911, most operations occurred after 1935 and consisted of two general types: (1) mechanized Army training and maneuvers and (2) military aircraft operations, maintenance, and support. Intensive Army activity occurred with the onset of World War II and continued through demobilization following the war. Major aircraft operations were associated with surveillance and air defense aircraft and occurred from 1955 to 1970. Although aircraft operations continue today, the greatest potential for release of contaminants to the environment was between 1940 and 1970. Tenants at MMR include, or have included, the U.S. Coast Guard, ARNG (Camp Edwards), USAF, ANG (Otis Air National Guard Base), Veterans Administration National Cemetery, U.S. Marine Corps, U.S. Department of Agriculture, and the Commonwealth of Massachusetts. The USAF managed MMR until 1973, when base management was transferred to ANG.

Activities at MMR that had the potential to contaminate the environment included the storage, handling, and disposal of solvents and petroleum fuels as well as the leakage of these materials into storm water drainage systems and the sanitary sewer system. Landfill operations, firefighter training, coal and ash storage, and numerous chemical and fuel spills also resulted in environmental contamination.

Before 1956, CS-10/FS-24 consisted of a wooded area. A rifle range (G Range) was located south of this area and north of Dolan Road. Construction of a BOMARC missile site began in 1958. Between 1960 and 1973, the USAF maintained approximately 56 BOMARC ground-to-air missile launcher systems in a state of operational readiness. These former missile launcher shelters are located within CS-10B along with a subsurface utility corridor connecting the shelters (utilidor system). Former missile maintenance and support facilities are located within CS-10A. Maintenance operations involved the use of cleaning solvents [methylene chloride, 1,1,1-trichloroethane (1,1,1-TCA), trichloroethylene (TCE), tetrachloroethylene (PCE), and Freon]. BOMARC fuels included JP-4, Aerozine-50, red fuming nitric acid, and hydrazine. Fuels used for power and heat generation included No. 2 fuel oil and diesel fuel. Several buildings had floor drains connected to leaching wells, building sumps, oil interceptors, and other drainage structures; some of these drainage structures were connected to the site storm drain system, which discharges to either the Eastern Storm Sewer Drainage Impoundment or the Southern Storm Sewer Outfall Drainage Ditch. The USAF abandoned the facility in 1973.

In 1978, the ARNG incorporated the abandoned missile facility into Camp Edwards and began limited use of the abandoned buildings for equipment maintenance and storage. UTES has been in operation at CS-10/FS-24 since 1978. UTES personnel are responsible for maintaining 300 to 350 armored and wheeled vehicles used for Camp Edwards ARNG training activities. Motor oil, hydraulic fluid, battery electrolyte, PCE, PD-680 Safety Clean, paints, and paint removers have been used on-site.

FS-24 designates a fuel spill associated with the 1985 removal of a 25,000-gallon underground storage tank (UST) located at the northwest corner of Building 4606 in CS-10A. Fewer than 500 gallons of No. 2 fuel oil were reportedly released during the removal process. Soils affected by the fuel spill were excavated to the maximum extent possible and removed from the site, and the excavation was backfilled with clean sand.

2.2.2 History of Site Investigations

Because of the nature of BOMARC operations and reported spillage of waste oils and solvents during transfer at UTES, AOC CS-10/FS-24 was identified as a chemical spill and disposal site by the U.S. Army Environmental Hygiene Agency (AEHA) (U.S. AEHA 1986). In July 1985, AEHA installed monitoring wells at AOC CS-10/FS-24 to determine the possible impact of UTES/BOMARC activities on local groundwater quality. The AEHA hydrogeologic study concluded that activities at the UTES/BOMARC site may have caused some groundwater contamination in the upper 20 feet of the aquifer and that some of the detected groundwater contaminants may have migrated downgradient from the site (U.S. AEHA 1986).

As part of the Task 3-1 base water supply studies from April 13 to June 3, 1986, AEHA-2, AEHA-5, and a monitoring well cluster installed crossgradient to AOC CS-10/FS-24 were monitored. Test results from these groundwater analyses did not indicate the presence of concentrations of solvents (i.e., TCE or PCE) in the groundwater (E.C. Jordan Co. 1987).

A records search for AOC CS-10/FS-24 was conducted concurrently with Task 3-1. The records search identified potential site contaminants as halogenated solvents, nonhalogenated solvents, hydrocarbons, battery electrolytes, and degradation products of Aerozine-50. Based on findings of the records search, additional studies were recommended for the site.

The record search identified the 500-gallon fuel spill that occurred in 1985 during decommissioning of the 25,000-gallon UST at Building 4606 as the BOMARC Area Fuel Spill Site (AOC FS-24). All visibly contaminated soil associated with the fuel spill reportedly was cleaned up.

An SI at AOC CS-10/FS-24 was conducted in 1989. It included a limited soil gas survey in the vicinity of the tank wash point, excavation of two test pits, installation of seven soil borings completed as water table monitoring wells with 10-ft screens, and field gas chromatograph screening and laboratory analyses of soil samples, sediment, and groundwater from the site (E.C. Jordan Co. 1989a). Soil, sediment, and groundwater were analyzed for target compound list (TCL) parameters. Groundwater was also analyzed for nitrate and nitrite.

Because of the detection of chlorinated solvents in groundwater beneath AOC CS-10/FS-24 during the SI, it was concluded that UTES and BOMARC maintenance and operational activities had resulted in site contamination and that the soil source(s) of groundwater contamination might still exist at the site. The SI recommended that further site confirmation studies be conducted and stated that additional information might support the recommendation for a Remedial Investigation/Feasibility Study (RI/FS) (E.C. Jordan Co. 1990a).

An additional water table monitoring well was completed near the Southern Storm Sewer Outfall at AOC CS-10. The absence of contamination in this single monitoring well was interpreted to indicate that the storm sewer effluent was not contributing to groundwater contamination and that groundwater contamination that might have been migrating from AOC CS-10/FS-24 sources had either not reached that location or was sinking below the water table with distance from the site.

Based on the results of the S1 and results of monitoring well data collected by the ARNG, a Decision Document concerning the tank wash point operable unit (CS-10C) at AOC CS-10/FS-24 was written (E. C. Jordan Co. 1990b). The Decision Document concluded that there was no significant contamination present at the wash point and that no further IRP investigations would be conducted at that operable unit.

Fieldwork for the RI/FS at AOC CS-10/FS-24 was completed in 1993. After that time, potential degradation, physical transport, and leaching of contaminants to deeper portions of the soil could have occurred, thus presenting substantial data gaps with regard to establishing contaminant volumes and concentrations for remedial actions. Therefore, confirmatory sampling (Table 2-1) was conducted in June 1996 to provide data needed to evaluate appropriate treatment technologies. The confirmatory sampling was also designed to provide current media concentrations for estimating soil and sediment volumes. Ten source areas were investigated and identified as Details A through I and Building 4606. Results of the confirmatory sampling effort indicated that because of the shallow depth of contamination, ex situ treatment technologies should be considered for Details A, B, D, E, F, and I. These results also indicated that in situ treatment technologies should remain a consideration for Detail C because it has the potential for contamination at a depth of 30 feet. Because the confirmatory sampling results did not confirm the RI results for Details G and H, indicated that these areas could be sampled to confirm that a No Further Action determination could be supported.

The Focused Feasibility Study (FFS) was prepared to evaluate remedial options to manage site risks identified at the AOC. In December 1998, utilidor and sump sampling of surface water and sediment at Building 4602 was conducted in response to public concern expressed during a site visit. Preliminary data are available for review.

Additionally, in 1998 supplemental sampling and analysis for asbestos, radionuclides, and explosives was conducted. Results of these investigations are discussed in Sections 2.5.1.10 through 2.5.1.12.

2.2.3 Enforcement History

On November 21, 1989, USEPA placed MMR on the NPL under CERCLA, as amended by SARA, to evaluate and implement response actions to clean up past releases of hazardous substances, pollutants, and contaminants. A Federal Facility Agreement (FFA) between the National Guard Bureau (NGB) [representing all Department of Defense (DOD) agencies owning or controlling property at MMR], the U.S. Coast Guard, and USEPA was signed in 1991 and amended in 1996 and 1997; schedules were modified in 1998. The FFA established a procedural framework for ensuring that appropriate response actions are implemented and required the NGB to take the lead in cleanup activities at MMR, including AOC CS-10/FS-24, which is considered a subsite to the entire installation. AFCEE currently provides on-site management and direction for the execution of cleanup activities at MMR in accordance with the FFA.

In response to environmental contamination at MMR, DOD implemented its multiphase IRP at MMR to identify and evaluate problems associated with past releases of hazardous substances. The IRP parallels the USEPA CERCLA investigation and cleanup process. The NGB, and subsequently AFCEE, followed USEPA guidelines for most IRP investigations performed between 1986 and 1989 and for all investigations performed since 1989.

In 1986, an extensive records search and review of available soil and groundwater data identified 73 areas at MMR as having the potential for contamination (E.C. Jordan Co. 1986). Four additional areas were later identified through anonymous sources and unrelated base construction projects, bringing the total to 77.

The Proposed Plan (AFCEE 1998) for remedial action for contaminant source areas at AOC CS-10/FS-24 was issued in September 1998 for public comment. The comment period was extended 30 days at the request of the public. Technical comments presented during the public comment period are included in the Administrative Record. The Responsiveness Summary is included in Appendix

C. It contains a summary of these comments and AFCEE's responses and describes how these comments affected the remedial action decision for AOC CS-10/FS-24. All written comments received during the public comment period are included as an attachment to the Responsiveness Summary. A transcript of the October 1, 1998 Public Hearing on the Proposed Plan is included in Appendix D. A letter of concurrence from the Commonwealth of Massachusetts is included in Appendix E.

2.3 HIGHLIGHTS OF COMMUNITY PARTICIPATION

The NGB and AFCEE have held regular informational meetings, issued fact sheets, and held public meetings to keep the community and other interested parties informed of activities at the AOC covered in this ROD.

Throughout MMR's history, community concern and involvement have been high. NGB, AFCEE, USEPA, and MADEP have kept the community and other interested parties apprised of site activities through informational meetings, fact sheets, news releases, public hearings, and Technical Environmental Affairs Committee (TEAC) meetings. TEAC was organized in 1986 by NGB to provide a forum for public input on MMR response activities. Membership on TEAC comprises USEPA, MADEP, and representatives from local, regional, and state groups. Beginning with the October 7, 1992 TEAC meeting, members of the public could attend these bimonthly meetings. TEAC ceased meeting in 1996 and is no longer in existence.

During May 1991, an MMR Community Relations Plan was released that outlined a program to address community concerns and keep citizens informed and involved in the remediation process at MMR. In July 1994, and again in December 1996, an updated Community Relations Plan (AFCEE 1996) was issued to incorporate concerns and feedback provided by the community and to document changes in AFCEE policy, such as the public attendance at TEAC meetings.

In October 1993, NGB created three Process Action Teams (PATs) to address specific issues at MMR: plume containment, long-range water supplies, and innovative technologies. A fourth PAT, the Public Information Team, was later created to advise on public involvement issues such as the AOC CS-10/FS-24 Proposed Plan and associated activities. PATs have representation from the community, local business, regulatory agencies, and AFCEE. A Senior Management Board also was created to review the work of the PATs. A selectperson from each of the four towns surrounding MMR is among the Board members, along with the representatives from regulatory agencies and the Adjunct General's Office of the Commonwealth of Massachusetts. The PATs and the Senior Management Board advise NGB and AFCEE on IRP activities.

AFCEE published a notice and brief analysis of the Proposed Plan in the *Falmouth and Mashpee Enterprises, the Cape Cod Times,* and the *Bourne and Sandwich Enterprises* on September 4, 1998. Additional advertisements announcing the Public Hearing were published in the *Falmouth and Mashpee Enterprises* on September 18, 1998; the *Cape Cod Times* on September 21, 1998; and the *Bourne and Sandwich Enterprises* on September 25, 1998. A notice that the public comment period had been extended 30 days was published in the *Cape Cod Times* on October 19, 1998 and rerun with a correction on October 22; this notice was also published in the *Falmouth and Mashpee Enterprises* on

October 20, 1998; and the *Bourne and Sandwich Enterprises* on October 23, 1998. A notice that additional Public Hearings would be conducted was published in the *Falmouth and Mashpee Enterprises* on October 30, 1998; the *Cape Cod Times* on November 3, 1998; and the *Bourne and Sandwich Enterprises* on November 6, 1998. Before the start of the comment period, AFCEE made the RI reports, the FFS report, and the Proposed Plan available for public review at the U.S. Coast Guard library at MMR and the main public libraries in Bourne, Falmouth, Mashpee, and Sandwich, Massachusetts. The Proposed Plan has also been made part the Administrative Record available for public review at the AFCEE IRP Office at MMR and at the Falmouth Public Library.

From September 14, 1998, to October 14, 1998, AFCEE held a 30-day public comment period to accept public comments on the remedial action alternatives presented for the AOC in the Proposed Plan. At the request of the public, the comment period was extended for 30 days, closing on November 13, 1998. On September 10, 1998, AFCEE held a public meeting at the Sandwich Public Library in Sandwich, Massachusetts, to present and discuss the Proposed Plan. On October 1, 1998, AFCEE held a Public Hearing to accept verbal comments on the Proposed Plan. Several residents and local officials attended the hearing and provided 44 verbal comments. AFCEE's responses to the comments received at the hearing and during the public comment period are included in Appendix C. A transcript of the October 1, 1998 Public Hearing is included in Appendix D. These written and verbal comments, which covered a wide range of topics, have been summarized below into 17 subject categories.

1. Requests for extension of the comment period so that more information could be provided to the public about the asphalt-batching process.
2. Comments requesting that the cleanup proceed as quickly as possible.
3. Comments supporting the Proposed Plan for CS-10/FS-24.
4. Comments claiming the Proposed Plan for CS-10/FS-24 is unacceptable.
5. Comments concerning other remedial alternatives.
6. Comments concerning the RI and the extent of contamination at CS-10/FS-24.
7. Comments concerning the sampling for explosives.
8. Comments concerning the sampling of the drainage ditch and the residential neighborhood.
9. Comments concerning the sampling for radionuclides at the BOMARC site.
10. Comments concerning the disposition of the missiles at the BOMARC site.
11. Comments concerning the asphalt-batching process.
12. Comments concerning air quality monitoring and health and safety issues during implementation of the asphalt-batching alternative.
13. Comments concerning the covering of contaminated soils during implementation of the asphalt-batching alternative.
14. Comments concerning the fate of contaminants after the asphalt batch has been placed into the environment.
15. Comments concerning risk to humans during implementation of the asphalt-batching alternative.
16. Comments concerning the disposition of the existing buildings and asbestos.
17. Miscellaneous comments.

2.4 SCOPE AND ROLE OF RESPONSE ACTION

AOC CS-10/FS-24 consists of two soil operable units: CS-10A and CS-10B. Six areas within CS-10/FS-24 have been identified as requiring remediation based on identified human health and ecological risks. Three additional areas have also been recommended for remediation based on soil contamination above MMR risk-based and leaching-based Soil Target Cleanup Levels (STCLs), which are discussed below in Section 2.10.1. These nine source areas have been designated Details A through I.

The selected remedy for the source areas at AOC CS-10/FS-24 is Excavation, On-site Asphalt Batching and Off-site Disposal/In Situ Thermally Enhanced SVE/Environmental Monitoring. This remedial action is a source control action designed to address the two principal threats at AOC CS-10/FS-24: (1) exposure of human and ecological receptors to surface soil, sediment, and surface water and (2) exposure to contaminated groundwater resulting from potential leaching of VOCs, SVOCs, pesticides, PCBs, inorganics, and TPH compounds into groundwater. Although groundwater exposure is not specifically addressed as an exposure pathway for this source control action, groundwater exposure is relevant on a larger scale where potential downgradient receptors may be exposed to COCs in groundwater from a number of possible sources including AOC CS-10/FS-24. As a result, groundwater is being addressed as a separate groundwater operable unit (CS-10D)) in *UTES/BOMARC and BOMARC Area Fuel Spill, AOC CS-10 Groundwater Operable Unit: CS-10D and Hydrogeologic Region II Study* (CDM Federal 1996). Therefore, except for the use of STCLs to prevent exposure via the leaching pathway, groundwater remediation is not addressed in this ROD.

This selected remedial action consists of removal of contaminated surface water from the Detail F drainage impoundment for disposal at the base wastewater treatment plant or an off-site treatment plant, excavation of contaminated surface soils and sediments from seven of the nine source areas (Details A through F, and I), and on-site treatment of excavated soils using asphalt batching. Also included is the design, construction, and operation of a thermally enhanced soil vapor extraction (SVE) treatment system to clean up deeper soils at Detail C; sampling and analysis of soils at Details G and H to confirm findings that there are no COCs in exceedance of STCLs at those two source areas; post-excavation confirmation sampling to ensure that all surface soils and sediments with COC concentrations exceeding STCLs are removed; implementation and maintenance of access restrictions, and 5-year reviews of remedy protectiveness at all AOC CS-10/FS-24 source areas. The remedy addresses the principal threats by reducing the mobility and volume of contaminated soils and sediment such that human health and ecological risks do not exceed federal and state risk management guidelines designed to protect human health and the environment. If sampling indicates that COC concentrations are below STCLs at Details G and H, then no further action will be performed at the source areas; if COC concentrations are found to exceed STCLs, then further action will be recommended. In addition, as part of the remedial design, it will be determined whether additional remedial action is warranted with regard to the Building 4606 drainage structures, including but not limited to removal of the drainage structures and all contaminated liquids in the structures, an investigation to determine the source of contamination in the structures and characterize any soil contamination associated with the structures, and excavation and/or treatment of any contaminated soils.

2.5 SITE CHARACTERISTICS

Nine discrete source areas at AOC CS-10/FS-24 are being addressed in this ROD for remediation based on the levels of contamination detected during the RI in surface water, sediments and surface/subsurface soils. A brief description of each source area follows. A detailed illustration of the BOMARC site is provided in Figure 2-3, Appendix A. The locations of the nine source areas (Details A through I) are illustrated in Figure 2-4, Appendix A.

Detail A consists of surface soil contamination associated with an abandoned electrical switching station. The switching station is located southeast of Building 4672.

Detail B consists of surface soil contamination associated with operations at a former BOMARC maintenance shop. The surface soil contamination is located northeast of Building 4641.

Detail C consists of subsurface soil contamination associated with a former 300-gallon jet propellant fuel (JP-4) UST. The UST was located on the north side of Building 4602.

Detail D consists of surface soil contamination associated with waste oil disposal activities. The disposal site is located in a clearing in the woods approximately 150 feet north of the BOMARC security fence.

Detail E consists of surface soil and sediment contamination associated with the Southern Storm Sewer Outfall Drainage Ditch. One 24-inch-diameter storm sewer discharges to a drainage ditch located south of Building 4601, outside the BOMARC security fence. The storm sewer receives runoff from southern portions of AOC CS-10. In the past, effluent from the leaching wells at Building 4606 and effluent from the waste oil interceptor at Building 4601 also discharged at the Southern Storm Sewer Outfall.

Detail F consists of surface soil and sediment contamination associated with the Eastern Storm Sewer Outfall Drainage Impoundment. The drainage impoundment is located northeast of Building 4600 just outside the BOMARC security fence. Four storm sewer outfalls discharge to this impoundment. One storm sewer receives runoff from a parking lot located immediately to the south of the impoundment. One receives runoff from the vicinity of the Building 4600 area. Another receives runoff from the area around Buildings 4641 and 4642. In the past, effluent from the former Weapons Systems Electronics Shop’s oil interceptor also drained through this storm sewer at Building 4642. The remaining storm sewer receives runoff from the central portion of AOC CS-10/FS-24 from near Buildings 4606 and 4602. In the past, discharge from the Building 4602 shop area floor trench drains also drained through this storm sewer.

Detail G consists of subsurface soil contamination associated with a former 25,000-gallon UST. The UST was located off the northeast corner of Building 4606. Detail G is also known as FS-24.

Detail H consists of subsurface soil contamination associated with a former storage area that was located adjacent to, and immediately west of, former Building 4642.

Detail I consists of surface and subsurface soil contamination associated with maintenance operations at Building 4601. Detail I is located immediately southeast of Building 4601.

A significant portion of the source area contamination at AOC CS-10/FS-24 appears to have been associated with a number of drainage structures formerly located there. The liquid and sediment within many of these drainage structures were found to contain VOCs, SVOCs, pesticides, PCBs, inorganics, and TPH. These structures, including the surrounding soils and associated piping, were removed. Under the DSRP, 15 drainage structures and surrounding soils were removed and 2 drainage structures were cleaned and filled in place with concrete (Jacobs Engineering Group 1995). In addition to the drainage structures, a total of 31,550 gallons of liquids were removed from the structures and treated at an off-base industrial wastewater treatment facility, and 702 cubic yards (cy) of contaminated soils were removed and sent to an on-site asphalt-batching facility.

Three drainage structures were not removed from CS-10/FS-24 during the DSRP due to lack of access. In July 1999, during the removal of liquids from drainage structures in Building 4606, additional contamination was found. The source of this contamination has not been identified. Upon further investigation, it will be determined whether additional remedial action is warranted. Such remedial action may include but not be limited to removal and proper disposal of all contaminated liquids in the Building 4606 drainage structures, removal of the drainage structures, an investigation to determine the source of the contamination and characterize the nature and extent of any soil contamination associated with the structures, and excavation and/or treatment of any contaminated soils.

2.5.1 Soil Contamination

Sediment and surface/subsurface soil samples at Details A through I exhibited concentrations of VOCs, SVOCs, pesticides, PCBs, and inorganics above the MMR STCLs. This contamination generally occurred less than 20 feet bgs. Depths of contamination at each detail were estimated based on RI sampling. A supplemental investigation was conducted for the FFS to address potential chemical degradation and migration. In the supplemental investigation in 1996, confirmatory sampling was performed to determine actual depths of contamination and the current level of contamination so that appropriate remedial technologies could be used. The nature and extent of contamination at each detail was revised based on results from the supplemental investigation and is discussed below.

2.5.1.1 Detail A

Surface soil samples collected during the RI in the vicinity of the abandoned electrical switching station along the utilidor were found to contain TPH at concentrations exceeding the leaching-based STCL for TPH (which is based on MCP leaching criteria) and metals at concentrations posing potential ecological risks (Table 2-2). TPH is composed of both carcinogenic (e.g., PAHs) and noncarcinogenic compounds (e.g., xylene). TPH exceeding the MCP leaching-based criteria suggests that leaching to groundwater may be a primary transport pathway at Detail A. Copper and lead exceed ecological STCLs. These metals are persistent in the environment and are transported via uptake and bioaccumulation in the food chain, resulting in potential systemic effects in ecological receptors.

A sample collected at a depth of 5 feet bgs during the supplemental investigation exhibited TPH below the method detection limit (29.6 µg/g), and all metals were below their respective STCLs. To be conservative, it was assumed that the extent of TPH and metals contamination ranged from a depth of 0 to 5 feet bgs for the purpose of calculating contaminated soil volumes. The volume of contaminated soil at Detail A is approximately 28.5 cubic yards (cy).

2.5.1.2 Detail B

Surface soil samples were collected at a depth of 1 feet bgs during the RI. SVOCs and TPH were detected above the STCLs (Table 2-3). The SVOCs 4-nitrophenol and phenanthrene were detected at levels posing a potential ecological risk via food chain exposure pathways. TPH exceeded the MCP leaching-based STCL for TPH. As with Detail A above, this indicates that leaching to groundwater may be a primary transport pathway at Detail B.

A sample was collected at a depth of 5 feet bgs during the supplemental investigation. No concentrations of SVOCs or TPH were exhibited above method detection limits. (The range of SVOC detection limits is 72 to 1,400 µg/kg; the TPH detection limit is 29.6 µg/g). For the purpose of calculating contaminated soil volumes, it was assumed that SVOC and TPH contamination extended from 0 to 5 feet bgs. The volume of contaminated soil at Detail B is approximately 53 cy.

2.5.1.3 Detail C

Subsurface soils ranging from 3 to 15 feet bgs at Building 4602 and adjacent to UST TS-1 contain PCE and TPH at concentrations exceeding the STCLs (Table 2-4). PCE is a carcinogen, and TPH is composed of both carcinogenic and noncarcinogenic compounds. Both TPH and PCE were detected at concentrations exceeding their respective leaching-based STCLs, suggesting that leaching to groundwater may be a primary transport pathway at Detail C.

During the supplemental investigation, soil samples were collected from two soil borings at Detail C. Two soil samples were collected from each boring at depths of 15 and 30 feet bgs. In one boring, TPH (420 µg/g) was detected at a depth of 15 feet at concentrations below the STCL (500 µg/g); however, PCE was detected in the other boring at a concentration of 690 µg/kg, which exceeds the STCL (10 µg/kg). Samples collected at 30 feet bgs contained no PCE or TPH contamination above the method detection limits (10 µg/kg and 29.1 µg/g, respectively). To be conservative, it was assumed PCE contamination ranged from 0 to 30 feet bgs. Because contaminated soils are likely to exist below a depth of 15 feet, excavation was not considered viable at this location; in situ treatment technologies will be considered for this location.

2.5.1.4 Detail D

Surface soil samples collected during the RI at the waste oil disposal site exhibited TPH and methylene chloride concentrations that exceed STCLs for leaching, suggesting the leaching of these COCs to groundwater may be a primary transport pathway. Methylene chloride is a carcinogen, and TPH compounds are predominantly carcinogens. Lead was detected at concentrations posing a potential ecological risk in surface soils (Table 2-5). This metal is persistent in the environment and is transported via uptake and bioaccumulation in the food chain, resulting in potential systemic effects in ecological receptors.

During the supplemental investigation, six soil samples were collected at ground surface and at 5 feet bgs from three locations. TPH (28100, µg/g in a blank sample) and acetone concentrations (20 µg/kg) were detected below the STCLs or below the method detection limit in all samples. To be conservative, soil contamination was assumed to exist from ground surface to a depth of 2 feet for a total estimated volume of 44.5 cy.

2.5.1.5 Detail E

During the RI, surface soil samples were collected from 0 to 2 feet bgs at the Southern Storm Sewer Outfall Drainage Ditch. These samples exhibited concentrations of polynuclear aromatic hydrocarbons (PAHs), dieldrin, and metals that pose potential ecological risks (Table 2-6). These COCs are persistent in the environment and are transported via uptake and bioaccumulation in the food chain, resulting in potential systemic effects in ecological receptors. Also, TPH was detected above the MCP leaching-based STCL for TPH, suggesting that leaching to groundwater may be a primary transport pathway at Detail E.

During the supplemental investigation, soil samples were collected from one location at depths of 0 and 5 feet. Dieldrin (126 µg/kg diluted sample result) was detected at concentrations above the STCL (35 µg/kg) at ground surface; however, all pesticides (detection limits ranged from 0.692 µg/kg to 86.4 µg/kg) were below the method detection limit at a depth of 5 feet. Soil contamination was assumed to exist at a depth of 5 feet, resulting in an estimated volume of 93 cy.

2.5.1.6 Detail F

Based on RI analyses, surface soil and sediment samples collected from 0 to 4 feet bgs at the Eastern Sewer Outfall Drainage Impoundment were found to pose unacceptable ecological risk from PAHs, Aroclor-1254, dieldrin, and several metals. PAHs, metals, and pesticides are persistent in the environment and could pose a continuing threat to potential human and ecological receptors. Manganese, a noncarcinogenic metal, and Aroclor-1254, a carcinogen, were detected at concentrations exceeding human health STCLs. These COCs are persistent in the environment and relatively immobile. In addition, TPH was detected at concentrations exceeding the MCP leaching-based STCL for TPH in surface soils. TPH exceeding the MCP leaching-based STCL suggests that leaching to groundwater may be a primary transport pathway at Detail F. Methylene chloride was detected; however, the depth of this contamination was not defined. Samples of surface water exhibited concentrations of metals at levels posing unacceptable ecological risks (Tables 2-7 and 2-8).

To determine the depth of methylene chloride contamination, eight soil samples were collected from three locations as part of the supplemental field investigation and analyzed for VOCs. Soil samples were collected at depths of 0, 15, and 30 feet bgs in two borings. None of the samples exhibited concentrations of VOCs above the method detection limits (detection limit range 10 to 11 µ/kg). A surface soil sample and duplicate were collected at a third location where acetone (30 µg/kg) was detected at concentrations below the STCL (6,250 µg/kg). Methylene chloride was not detected in any of the samples. It was assumed, based on the supplemental data, that contaminated soils extended to a depth of 5 feet bgs resulting in volume estimates of 56 cy for swale soils and 1,102 cy for sediments.

2.5.1.7 Detail G (FS-24)

During the RI, TPH (2,360,000 µg/kg) was detected in subsurface soils from 19 to 94 feet bgs at concentrations exceeding the STCL (500,000 µg/kg) (Table 2-9). TPH exceeding the MCP leaching-based STCL, which suggests that leaching to groundwater may be a primary transport pathway at Detail G. Methylene chloride, a carcinogenic COC that readily leaches to the subsurface, was also detected (110,000 µg/kg) above the leaching-based STCL (10 µg/kg); however, the depth of contamination was not well defined.

As part of the supplemental field investigations, six soil samples were collected from two locations and analyzed for TPH and VOCs. One sample was analyzed for parameters to determine suitability for SVE or bioventing. Five detections of TPH (29.2 to 86.3 µg/g) were below the STCL (500 µg/g). Two detections of TPH (blank samples at 40 feet bgs) exceeded the STCL (8,300 to 8,340 µg/g). PCE was detected in one sample collected at a depth of 40 feet bgs and in a duplicate sample at concentrations of 16 and 13 µg/kg, respectively; the STCL for PCE is 10 µg/kg. All other concentrations of VOC constituents were below the method detection limit.

2.5.1.8 Detail H

Data from the RI revealed TPH and PCE contamination above the leaching-based STCLs in soils from 2 to 12 feet bgs at Grid #3, west of Building 4642. The depth of contamination was not defined (Table 2-10). The exceedance of leaching-based STCLs by TPH and PCE suggests that leaching to groundwater may be a primary transport pathway at Detail H. During supplemental field investigations, 15 samples were collected from 5 locations at depths of 10, 15, and 30 feet bgs and analyzed for TPH and VOCs. TPH detections ranged from 23.1 µg/g at 15 feet bgs to 3 1.1 µg/g at 30 feet bgs, all of which were below the STCL (500 µg/g). Acetone was detected in two samples at 10 feet bgs at 13 µg/kg and 28 µg/kg, all of which were below the STCL (6,250 µg/kg). A sample was also analyzed for parameters to determine the suitability of excavation/asphalt batching, in situ SVE, or in situ bioventing.

2.5.1.9 Detail I

Shallow soil samples were collected at depths of 1 to 2 feet bgs in the vicinity of TP-3 at Building 4601. The samples exhibited concentrations of PCE at levels exceeding leaching-based STCLs suggesting that leaching to groundwater may be a primary transport pathway at Detail I (Table 2-11). Concentrations of bis(2-ethylhexyl)phthalate and several metals exceeded ecological STCLs and pose potential ecological risks. The depth of PCE contamination was not defined during the RI. As part of supplemental field investigations, six soil samples were collected from two locations at depths of 10, 15, 25, and 30 feet bgs and were analyzed for VOCs. None of the samples exhibited concentrations of VOCs above the method detection limit. To be conservative, it was estimated that contamination extended to a depth of 10 feet, resulting in an estimated volume of 333.5 cy of contaminated soils.

2.5.1.10 Asbestos Sampling

In July 1998, surface soil and sediment samples were collected at Details A through F and I and sent to a laboratory to be analyzed for asbestos. Results of the asbestos sampling can be found in a Technical Memorandum submitted to MADEP and USEPA in July 1998 (HAZWRAP 1999a). No concentrations of asbestos in soils at Details ASF and I at AOC CS-10/FS-24 were found greater than 1%. Therefore, asbestos in soils should not pose a problem with regard to any of the remedial alternatives proposed in the FFS for AOC CS-10/FS-24 (HAZWRAP 1998).

2.5.1.11 Explosives Sampling

In August 1998, surface soil and sediment samples were collected at Details A through I and sent to a laboratory to be analyzed for explosives. The explosives sampling was performed only within Details A through I and solely for the purpose of determining whether the soil within these areas could be used for asphalt batching. No groundwater samples were collected and analyzed for explosives during the sampling effort. Although trace levels of explosives were found (levels between the method detection limit and reporting limit of 0.25 mg/kg), they were at levels that do not require remediation or prevent the implementation of the proposed remedy.

2.5.1.12 Radiological Survey

During the autumn of 1998, a radiation survey was performed at the former BOMARC facility at AOC CS-10/FS-24. Preliminary results indicated that there were no weapons associated with radioactive contaminants at the site and associated facilities. Analysis of the data presented in the final report (ORNL 1999) confirms the preliminary findings that weapons-related radioactive contamination is not present in areas where nuclear weapons may have been stored or maintained. Random samples taken in other areas also indicate contamination is not present. Statistical analysis of the data confirms the results and indicates no justification for additional radiological characterization. This analysis shows that the BOMARC facility does not pose a radiological hazard to the environment, workers, visitors, or the public living in residential areas nearby.

2.5.1.13 Neighborhood Sampling

Soil and sediment sampling of the off-base drainage swale near Greenway Road was accomplished in October 1998. This sampling effort was coordinated with USEPA, MADEP, Massachusetts Department of Public Health, the Agency for Toxic Substances and Disease Registry (ATSDR), and the Joint Program Office. AFCEE collected surface soil samples at six locations in the swale. One sample was collected at the drainage pipe, another 25 feet away, and four more each 200 feet apart. AFCEE tested the samples for VOCs, SVOCs, PCBs, pesticides, TPH, explosives, and inorganics. According to the Massachusetts Department of Public Health and ATSDR, the results do not indicate any health concern. Preliminary analytical data were reported in November 1998 and validated in December 1998. The validated results are presented in a letter report entitled “CS-10 Swale Area Surface Soil Sampling Letter Report,” December 1999, and are available to the public upon request.

2.5.2 Groundwater Contamination

Groundwater contamination associated with the CS-10/FS-24 source areas is discussed in detail in *UTES/BOMARC and BOAMRC Area Fuel Spill, AOC CS-10 Groundwater Operable Unit: CS-10D and Hydrogeologic Region II Study* (CDM Federal 1995).

PCE, TCE, and lesser amounts of 1,2-dichloroethylene (DCE) are the main components of the downgradient plume, which extends over 10,000 feet south-southwest of the source area. The pattern of downgradient contamination suggests that releases of contaminants from the source area probably occurred on an irregular basis beginning in 1960 and continue to the present. These findings are consistent with the findings of the RI for AOC CS-10/FS-24, which found that the number of use-related contamination sources (such as leaching water, oil-water interceptors, storm drain catch basins, and drainage swales) contributed to soil, sediment, surface water, and groundwater contamination.

Although found throughout the source area, moderate to high levels [>20 micrograms per liter (µg/L)] of PCE occur primarily in the eastern portion of the source area. The highest groundwater concentrations of PCE are at MW-3, MW-14B, MW-18, and MW-91, which are near Building 4601. The source of these contaminants could have been releases to the ground from degreasing operations at Building 4601. The source of PCE also could have been operations at Building 4642, which is upgradient of Building 4601. Sediments from the leaching well at Building 4642 had elevated levels of PCE, TCE, and DCE. The groundwater at wells between Buildings 4642 and 4601 contained these chlorinated VOCs, although at levels lower than found at MW-3, MW14B, and MW-18.

Levels of TCE in groundwater throughout the source area are somewhat uniform, with the only concentration above 3 µg/L detected at MW-14B (at 16 µg/L). Thus, the TCE found in the downgradient plume is not readily traced to a specific source area location. In addition to operations at Buildings 4601 and 4642, other possible locations of chlorinated solvent releases in the source area include Building 4604 and Building 4618, which is located in CS-10B (elevated levels of PCE, TCE, and DCE were found in sediment samples from leaching wells near both buildings).

2.6 SUMMARY OF SITE RISKS

The risk assessment process for AOC CS-10/FS-24 consists of a PRA, which was conducted as part of the December 1997 RI. The PRA fulfills the CERCLA requirement that a baseline risk assessment be performed to establish whether remediation is necessary to protect human health and the environment.

The objective of the PRA was to provide an estimate of the baseline risks (i.e., risks in the absence of remediation—the No Action cleanup alternative) associated with soil, sediment, and surface water at AOC CS-10/FS-24. Baseline risks are estimated to determine whether a current or potential threat to human health or the environment exists that warrants remedial action (USEPA 1990). For risk assessment purposes, the source areas are considered to be (1) the CS-10A and CS-10B operable units including the waste oil disposal site (Details A through G and I); (2) the Eastern Drainage Impoundment (Detail F); and (3) the Southern Storm Sewer Outfall Drainage Ditch (Detail E). Contaminated media include soil and sediment at CS-10A and CS-10B; soil, sediment, and surface water at the Eastern Drainage Impoundment (East Pond); and sediment at the Southern Storm Sewer Outfall Drainage Ditch (Southern Drainage Ditch). Groundwater was not evaluated in this risk assessment. It will be evaluated in a subsequent report, as discussed previously.

The PRA was conducted in accordance with federal CERCLA human health and ecological risk assessment guidance, requirements set forth by the state of Massachusetts, and site-specific guidance provided in the MMR IRP RAH (Automated Sciences Group, Inc., 1994).

Actual or threatened releases of hazardous substances from AOC CS-10/FS-24, if not addressed by implementing the response actions selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

2.6.1 Human Health Preliminary Risk Assessment

For AOC CS-10/FS-24, the human health PRA consisted of five primary components: data evaluation, exposure assessment, toxicity assessment, risk characterization, and a summary of uncertainties.

2.6.1.1 Data Evaluation

In the data evaluation, three sources of sampling data were used to conduct the PRA.

- Phase II Drainage Structure Investigation—Priority One—Drainage Structure Survey Report (M&E 1993),
- Interim Remedial Investigation UTES/BOMARC and BOMARC Area Fuel Spill (AOC CS-10 and AOC FS-24) (ABB-ES 1992), and
- Final Remedial Investigation UTES/BOMARC and BOMARC Area Fuel Spill (AOC CS-10 and AOC FS-24) Source Operable Units: CS-10A and CS 10B (CDM Federal 1997).

A preliminary risk evaluation (PRE) was not conducted for the CS-10/FS-24 source; consequently, COCs were not previously established for the RI PRA. Using the above-referenced data, COCs were identified using the following criteria:

- Maximum concentrations of contaminants on-site were compared to risk/hazard equivalent concentrations (HECs) provided in Appendix F of the RAH. This conservative approach was taken to identify COCs to account for potential human health effects. Where no HEC values were available for comparison, compounds were selected as COCs.
- Comparison to site background was made, but no constituents were eliminated based on background.
- Because less than 20 samples were evaluated for each area of CS-10, frequency of detection was not a factor for COC selection.

The HECs are risk-based contaminant concentrations below which no adverse effects are expected to occur. HECs are calculated for each COC using worst-case exposure scenarios for a given land use and environmental medium (e.g., chromium HEC for residential exposure to soil outside the security zone). To ensure protectiveness, the target risks used to calculate the HECs are based on a 1 x 10^{-6} risk for carcinogens and a Hazard Index (HI) of 0.2 for noncarcinogens. These targets are considered conservative (e.g., biased toward health protectiveness) because the cancer target is at the low end of USEPA's target risk range (1 x 10^{-4} to 1 x 10^{-6}) and the HI target is set below USEPA's HI target of 1.0. This conservatism in selecting target risks for HEC calculation ensures that potential additive effects resulting from exposure to multiple contaminants is factored into the HEC calculation. Where no HEC values were available for comparison, compounds were automatically selected as COCs.

At CS-10A and CS-10B, eight SVOCs, two PCBs, one pesticide, and seven inorganics were identified as COCs (Table 2-12). At the East Pond, nine SVOCs, one PCB, one pesticide, and eight inorganics were identified as COCs (Table 2-13). At the Southern Drainage Ditch, three SVOCs and three inorganics were identified as COCs (Table 2-14).

2.6.1.2 Exposure Assessment

The exposure assessment identified potential exposure pathways, developed exposure scenarios based on current and future land use, and quantified exposure using standard USEPA risk assessment methods outlined in the RAH. Under current land use, potential receptors include workers associated with the current UTES operations in AOC CS-10A and trespassers, such as children and adults. These current receptors may also be future receptors. In addition, because AOC CS-10/FS-24 is located outside the security zone, another future receptor could be a resident adult or child.

Potential human exposure may occur primarily through dermal contact, inhalation, or ingestion. Potential current and future occupational exposure routes at the AOC may include:

- inhalation of VOCs and/or fugitive dust from surface soil and sediments,
- inhalation of VOCs from surface water, and
- incidental ingestion and dermal contact of surface water and sediment.

Occasionally, people may trespass on the site property outside the security zone. These people may include children and/or adolescents playing on the property and adults walking across the property. Potential current and future exposure routes for the trespassers may include:

- inhalation of VOCs and/or fugitive dust from surface soil,
- inhalation of VOCs from surface water,
- ingestion and dermal contact of with surface soils, and
- incidental ingestion and dermal contact of/with surface water and sediment.

Potential future exposure routes for residents living within the study area may include:

- inhalation of VOCs and/or fugitive dust from surface soil,
- inhalation of VOCs from surface water,
- ingestion and dermal contact of/with surface soil, and
- incidental ingestion and dermal contact of surface water and sediment.

Based on the identified current and potential future exposure pathways, the following exposure scenarios were evaluated in the exposure assessment.

- **Current Worker Scenario** Workers associated with current UTES operations in AOC CS-10A could come in contact with contaminated surface soil, sediment, and surface water through the operation and maintenance of UTES vehicles stored in the area. Inhalation of contaminants released from surface soil and surface water may also occur. Also, construction workers might be exposed to the above-noted media while repairing underground utilities.

- **Current Trespasser Scenario** Children and adults may trespass on the site, especially in the Eastern Storm Sewer Outfall Drainage Impoundment located outside the fenced areas of AOC CS-10/FS-24. Trespass may result in direct contact with contaminated media via ingestion, inhalation, and dermal contact.

- **Potential Future Resident** The potential for future residential exposure exists because the area outside the security zone has the potential to be developed as residential. For a future residential scenario, a resident may come into contact with COCs through the same exposure routes as that discussed above for trespassers: direct contact with contaminated media via inhalation, dermal contact, and ingestion.

2.6.1.3 Toxicity Assessment

The toxicity assessment evaluated and identified appropriate Cancer Slope Factors (CSFs) and noncarcinogenic reference doses (RfDs) used in quantifying human health risks. CSFs have been developed by USEPA's Carcinogenic Assessment Group for estimating excess lifetime cancer risks associated with exposure to potentially carcinogenic chemicals. CSFs, which are expressed in units of $(mg/kd\text{-}day)^{-1}$, are multiplied by the estimated intake of a potential carcinogen, in mg/kg-day, to provide an upper-bound estimate of the excess lifetime cancer risks associated with exposure at the intake level. The term "upper bound" reflects the conservative estimate of the risks calculated from the CSF. Use of this approach makes underestimation of the actual carcinogenic risks highly unlikely. CSFs are derived from the results of human epidemiological studies or chronic animal bioassays to which animal-to-human extrapolation and uncertainty factors have been applied.

RfDs have been developed by USEPA for indicating the potential for adverse health effects from exposure to chemicals exhibiting noncarcinogenic effects. RfDs, which are expressed in units of mg/kg-day, are estimates of lifetime daily exposure levels for humans, including sensitive individuals. Estimated intakes of chemicals from environmental media (e.g., the amount of a chemical ingested from contaminated drinking water) can be compared to the RfD. RfDs are derived from human epidemiological studies or animal studies to which uncertainty factors have been applied (e.g., to account for the use of animal data to predict effects on humans). These uncertainty factors help ensure that the RfDs will not underestimate the potential for adverse noncarcinogenic effects to occur.

Table 2-15 presents CSFs and RfDs selected for use in the PRA at AOC CS-10/FS-24.

2.6.1.4 Risk Characterization

The risk characterization combined dose estimates from the exposure assessment and toxicity information from the toxicity assessment to estimate chemical-specific and total pathway excess lifetime cancer risks (carcinogenic risk), noncarcinogenic Hazard Quotients (HQs), and total pathway HIs,

Excess lifetime cancer risks are determined by multiplying the intake level with the cancer potency factor. These risks are probabilities that are generally expressed in scientific notation (e.g., 1×10^{-6} or 1E-06). An excess lifetime cancer risk of 1×10^{-6} indicates that as a plausible upper bound, an individual has a one in one million chance of developing cancer as a result of site-related exposure to a carcinogen over a 70-year lifetime under the specific exposure conditions at a site.

Potential concern for noncarcinogenic effects of a single contaminant in a single medium is expressed as the HQ (the ratio of the estimated intake derived from the contaminant concentration in a given medium to the contaminant's RfD). By adding the HQs for all contaminants within a medium or across all media to which a given population may reasonably be exposed, the HI can be generated. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media.

Results of the PRA indicated carcinogenic and noncarcinogenic risks associated with all areas, environmental media, and receptors evaluated in the RI do not exceed USEPA risk management guidelines (carcinogenic risks within the USEPA target risk range of 10^{-4} to 10^{-6} and HQ/HI of less than 1.0). However, in some cases risks exceed the MCP carcinogenic risk management guideline of IE-05 (MCP 1994).

At the East Pond, current and future exposure to soil by workers results in a total pathway risk based on maximum concentration data of 1.51×10^{-5}; however, no individual COCs had a risk greater than 1×10^{-5}, the MCP risk guideline. Carcinogenic PAHs constitute approximately 92% of the total pathway risk.

Future exposure to soil by child residents (age 1 to 6 years) results in a total pathway risk based on maximum concentration data of 9.11×10^{-5}. Dibenz(a,h)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene have chemical-specific risks of 1.44×10^{-5}, 4.8×10^{-5}, and 1.28×10^{-5}, respectively, and constitute approximately 96% of the total pathway risk.

Future exposure to soil by residents (age 7 years to adult) results in a total pathway risk based on maximum concentration data of 3.96×10^{-5}. Only benzo(a)pyrene had a chemical-specific risk greater than 1×10^{-5} (the MCP risk guideline), which was 2.06×10^{-5}. Carcinogenic PAHs accounted for 95% of the total pathway risk.

At the Southern Drainage Ditch Area, current and future exposure scenarios resulted in risks greater than the MCP risk management guideline. Total pathway risk for current and future workers based on maximum sediment concentration data is 1.14×10^{-5}. Benzo(a)pyrene was the only COC with a chemical-specific risk greater than 1E-05 (the MCP risk guideline), which was 1.14×10^{-5}.

Future exposure to sediments by child residents (age 1 to 6 years) and residents (age 7 years to adult) resulted in total pathway risks based on maximum concentrations of 7.12 x 10^{-5} and 3.05 x 10^{-5}, respectively. In each scenario, benzo(a)pyrene was the only COC with a chemical-specific risk greater than 1 x 10^{-5}, the MCP risk guideline (age 1 to 6 years risk = 7.12 x 10^{-5}; age 7 to adult = 3.05 x 10^{-5}).

At CS-10A and B, current and future exposure scenarios resulted in risks greater than the MCP risk management guideline. Total pathway risk for current and future workers based on maximum sediment concentration data is 2.41 x 10^{-5}. Aroclor-1254 is the only COC with a chemical-specific risk greater than 1 x 10^{-5}, the MCP risk guideline. Aroclor-1254 accounts for approximately 95% of total pathway risk for both mean and maximum results.

Future exposure to sediments by child residents (age 1 to 6 years) and residents (age 7 years to adult) resulted in total pathway risks based on maximum concentrations of 2.9 x 10^{-5} and 1.7 x 10^{-5}, respectively. In both scenarios, Aroclor-1254 was the only COC with a chemical-specific risk greater than the 1 x 10^{-5} MCP risk guideline (age 1 to 6 years risk = 2.9 x 10^{-5}; age 7 to adult risk = 1.7 x 10^{-5}).

Future exposure to soil by child residents (age 1 to 6 years) resulted in total pathway risks based on maximum concentrations of 1.82 x 10^{-5}. No COC had a chemical-specific risk greater than 1 x 10^{-5}, the MCP risk guideline.

2.6.1.5 Evaluation of Uncertainties

Uncertainties associated with the human health PRA are briefly summarized below.

- Data collected from three different time periods generated under different sampling and analysis plans were used to derive maximum detected COC concentrations for the PRA.
- COCs were selected using highly conservative HEC values resulting in the selection of a large number of COCs from the sampling data.
- In accordance with the RAH, COCs having no USEPA toxicity values (or provisional values) were not assessed quantitatively in the PRA. Physical/chemical characteristics were evaluated identifying 2-methylnapththalene as a potential volatile COC.
- The RfD for napthalene was used as a surrogate for benzo(g,h,i)perylene because no toxicity values were available.
- Dermal absorption factors were only available for PCBs and cadmium.
- Arsenic in the East Pond and beryllium in CS-10A and CS-10B are present at maximum concentrations exceeding an HEC but below background. These were evaluated with respect to background influence.

- The toxicity values provided by USEPA are considered conservative estimates of toxicity and result in conservative estimates of risk, which are likely to overestimate risks at the site.

- The source of PAHs at the AOC may or may not be site related, but they are evaluated as site-related compounds in the PRA.

2.6.2 Ecological Risk Assessment Summary

As with the human health PRA, the ecological PRA consists of five primary components: data evaluation, exposure assessment, effects assessment, risk characterization, and an assessment of uncertainties. In addition, like the human health PRA, AOC CS-10/FS-24 assessed potential risks separately for the East Pond/Marsh Area, the Southern Drainage Ditch Area, and CS-10A and CS-10B. These three areas were originally chosen based on differences in habitat, contaminants, and exposure pathways.

2.6.2.1 Data Evaluation

In the data evaluation, three sources of sampling data were used to conduct the PRA.

- Phase II Drainage Structure Investigation – Priority One – Drainage Structure Survey Report (M&E 1993),
- Interim Remedial Investigation UTES/BOMARC and BOMARC Area Fuel Spill (AOC CS-10 and AOC FS-24) (ABB-ES 1992a), and
- Final Remedial Investigation UTES/BOMARC and BOMARC Area Fuel Spill (AOC CS-10 and AOC FS-24) Source Operable Units: CS-10A and CS 10B (CDM Federal 1997).

No PRE was conducted for CS-10/FS-24; consequently, COCs were not previously established for the PRA. Using the above-referenced data, COCs were identified using the following criteria.

- Maximum concentrations of contaminants on-site were compared to USEPA Ambient Water Quality Criteria (AWQC), the Ontario Ministry of the Environment Sediment Quality Guidelines (SQG), the National Oceanic and Atmospheric Administration (NOAA) effects range-low (ER-L) and effects range-medium (ER-M) values for sediment, and the RAH ecological HECs for soils and sediment. Where no benchmarks were available for comparison, compounds were selected as COCs.

- Comparison to site background was made, but no constituents were eliminated based on background.

- Because less than 20 samples were evaluated for each area of CS-10/FS-24, frequency of detection was not a factor for COC selection. Comparison to site background was conducted.

At CS-10A and CS-10B, 10 SVOCs, 3 PCBs, 2 pesticides, and 10 inorganics were identified as COCs (Table 2-12). At the East Pond, 15 SVOCs, 1 PCB, 2 pesticides, and 10 inorganics were identified as COCs (Table 2-13). At the Southern Drainage Ditch, 9 SVOCs, 2 PCBs, 1 pesticide, and 10 inorganics were identified as COCs (Table 2-14).

2.6.2.2 Exposure Assessment

The exposure assessment evaluates the ecological setting, identifies potential exposure pathways and receptor species, and quantifies exposure. The East Pond Marsh Area consists of a 1.1-acre wetland habitat containing an area of open water surrounded by wetlands. These wetlands probably support numerous species including amphibians, reptiles, aquatic and semiaquatic birds, mammals, and associated predators.

The Southern Drainage Ditch consists of a 200-foot-long ditch approximately 10 feet wide that extends from a culvert into a pitch pine forest on the southern side of CS-10/FS-24. An edge community of approximately 0.5 acre exists between the grasslands around the AOC and the pitch pine forest. The area is inhabited by a variety of terrestrial vegetation, terrestrial birds, and small mammals.

CS-10A and CS-10B is a 38-acre area currently used for maintenance and storage of vehicles. Habitat consists of unmowed grass areas interspersed between building and paved areas. These areas transition into early and old field communities beyond the AOC boundaries. An extensive pitch pine barren spreads out away from the AOC to the north and northeast. These areas consist of a variety of grass, shrub, and tree species and support terrestrial bird and small mammal populations. Small mammals (e.g., mouse, shrew, and meadow vole) may be exposed to contaminants via direct contact or through ingestion of food and prey. Predators (e.g., red fox) may actively hunt and/or den in the area and be exposed via food chain bioaccumulation or direct contact. As with the fox, the short-eared owl and the northern harrier could be exposed to COCs by hunting small mammals. Other indicator species (e.g., grasshopper sparrow, upland sandpiper, and cardinal) may be exposed to contaminants via bioaccumulation while feeding on insects and fruits. The two raptor species, the sandpiper and the grasshopper sparrow, are ground nesters and could be exposed via dermal contact and inhalation.

Potential ecological receptors were identified for evaluation at all three study areas. They were selected to include those organisms that are likely to be exposed to site contamination through a variety of exposure pathways. In addition, species were selected to represent different trophic levels (position in the food chain) and life forms (i.e., mammals, birds, and plants). Endangered or threatened species present at MMR were also selected. Organisms that are chronically exposed to site-related chemicals were chosen over transient species because these organisms are likely to receive higher exposure doses. Organisms that are exposed through multiple exposure pathways were selected using the same reasoning. The representative receptor species selected for evaluation at the three study areas include:

- White-footed mouse (*Peromyscus leucopus*)
- Meadow vole (*Microtus pennsylvanicus*)
- Short-tailed shrew (*Blarina brevicauda*)
- Red fox (*Vulpes vulpes*)
- Muskrat (*Ondatra zibethicus*)
- Northern harrier (*Circus cyaneus*)
- Upland sandpiper (*Bartramia longicauda*)
- Short-eared owl (*Asio flammeus*)

- Black-crowned night-heron (*Nycticorax nycticorax*)
- Cardinal (*Cardinalis cardinalis*)
- Grasshopper sparrow (*Ammodramus savannarum*)

Exposure pathways identified for the three study areas are discussed below.

At the East Pond Marsh Area fish, macroinvertebrates, amphibians, and aquatic plants living in or near the pond represent the primary potential receptors. These receptors may be exposed to contaminated soil, sediment, and surface water via direct exposure routes associated with each contaminated medium.

At the Southern Drainage Ditch, small mammals (e.g., mouse, shrew, and vole) may be exposed through direct contact during burrowing activities and through indirect contact via uptake into food items. Higher predators (e.g., red fox), may hunt small mammals in this area. The fox could also be exposed via dermal contact or inhalation, if it had a den in the area. The cardinal, an omnivorous bird, could be exposed via the food chain as it consumes both plant material and invertebrates, which could contain contamination through direct contact with contaminated media.

At CS-10A and CS-10B, small mammals (e.g., mouse, shrew, and meadow vole) may be exposed to contaminants via direct contact or through ingestion of food and prey. Predators (e.g., red fox) may actively hunt and/or den in the area and be exposed via food chain bioaccumulation or direct contact. As with the fox, the short-eared owl and the northern harrier could be exposed to COCs by hunting small mammals. Other indicator species (e.g., grasshopper sparrow, upland sandpiper, and cardinal) may be exposed to contaminants via bioaccumulation while feeding on insects and fruits. The two raptor species, the sandpiper and the grasshopper sparrow, are ground nesters and could be exposed via dermal contact and inhalation.

2.6.2.3 Effects Assessment

The ecological effects assessment identifies the potential adverse effects associated with exposure to COCs. This assessment involves selecting applicable ecotoxicological benchmarks (i.e., a dose expected to be protective of receptor species exposed to COCs in surface soil via direct contact, inhalation, ingestion, or food chain pathways). Adjusted benchmarks for the identified receptor plant and terrestrial animal species applicable to the exposure routes being evaluated at AOC CS-10/FS-24 were obtained from the RAH and incorporated into the risk estimate summaries provided below in the risk characterization for each source area.

2.6.2.4 Risk Characterization

In the risk characterization, the exposure dose and HI were calculated to estimate risks using methods and benchmarks for a Tier III baseline ecological risk assessment outlined in the RAH and presented in the RI report (CDM 1997). The HI is cumulative by pathway for the COCs. For each COC, an HQ is calculated by dividing the exposure concentration (or the exposure dose for food chain exposure scenarios) by an ecotoxicological benchmark concentration (or benchmark dose for food chain exposures). The HI is the sum of the HQ values for all contaminants within the pathway. HIs less than 1.0 generally indicate a lack of appreciable effects from exposure to COCs. Because of the compounding of conservative assumptions used in selecting exposure and toxicity parameters for HI estimates, HIs slightly exceeding 1.0 (between 1.0 and 10.0) may also be interpreted as indicating a lack of appreciable effects from exposure to COCs under certain circumstances. For example, on-site habitat may be marginal or poor, other more suitable habitat may be readily available off-site, no threatened or endangered species are involved, or population level effects are not indicated. HIs exceeding 1.0 by a large margin (HI >10.0) indicate that appreciable adverse effects from exposure to COCs is likely and further evaluation or remedial action may be warranted.

Evaluation of risk to aquatic receptors is based on HIs developed using surface water and sediment contaminant concentration values. An HI is developed for both maximum and mean concentrations for each media by comparing the concentrations with appropriate benchmark values. For surface water HIs, the selected benchmarks used to calculate a chemical-specific HQ are provided in the RAH and are primarily AWQC values, In some instances, benchmarks for COCs are not available in the guidance nor have AWQC been established. In these instances, values found in the literature were reviewed, benchmarks were selected, and the source of the information was documented. In cases where benchmarks have not been identified and no relevant ecotoxicological data were available, an HQ for the COC was not calculated.

In evaluating sediment concentrations, equilibrium partitioning models for deriving sediment quality criteria (SQC) for nonionic organic chemicals and the use of acid volatile sulfide analysis for metals was employed. Both approaches result in an estimate of the pore water concentration, which can be compared to AWQC or other selected benchmarks. For CS-10/FS-24, SQCs were calculated and sediment concentrations were compared within NOAA ER-L and ER-M values, when available, to estimate an HQ. Sediment concentrations were also compared to the 1992 Ontario Ministry of the Environment LEL and SEL sediment guidelines. Where NOAA and Ontario sediment values were not available, it was conservatively assumed that the concentrations of the compound in the sediment and the water column were in equilibrium and the concentration of any given chemical noted for the sediments was reflective of the concentrations in pore spaces. These concentrations were subsequently compared directly to AWQC or other appropriate benchmarks.

The evaluation of risks to terrestrial and aquatic wildlife receptors is based on the risk associated with the terrestrial food chain. Wildlife species were evaluated by first selecting applicable indicator species. Indicator species were selected based on the following criteria.

- They are likely to be exposed to site-related chemical constituents.
- They are likely to be exposed by means of several exposure pathways.
- They are representative of species within their trophic level.
- They are representative of various phyla.
- They are representative of endangered or threatened species.

Aquatic species include the muskrat, mallard duck, American black duck, and the black-crowned night heron. Terrestrial species include the meadow vole, northern short-tailed shrew, upland sandpiper, grasshopper sparrow, white-footed mouse, northern cardinal, northern harrier, short-eared owl, and the red fox.

Exposure pathways evaluated for applicable aquatic and terrestrial wildlife species for the East Pond/Marsh Area, Southern Drainage Ditch Area, and the CS-10A and CS-10B Area include direct exposure via ingestion of soil/sediment and dermal contact with soil/sediment. Because of the potential for some chemical constituents to bioaccumulate through the food chain, -uptake via the food chain is another important exposure route considered. At the East Pond/Marsh Area, ingestion of surface water was also considered. While not all these exposure pathways are applicable to all species being considered (e.g., some predators do not ingest significant quantities of soil to warrant quantitative estimation of soil ingestion), these exposure routes are representative of the primary exposure pathways at the site and are quantified where applicable for the indicator species of interest.

The risk associated with the terrestrial and aquatic food chain is evaluated by estimating the exposure dose based on the organism's physical characteristics, feeding habits, and habitat preferences. Again, HQs are calculated for each contaminant present in an area and then summed to derive HIs for the indicator species.

At the East Pond Marsh Area, risks to aquatic life, terrestrial vegetation, and terrestrial and aquatic wildlife species were evaluated based on contamination identified in surface water, soil and sediment. HIs for aquatic life are summarized below.

East Pond Marsh Area Aquatic Hazard Indices						
COC Concentration	Surface Water	Sediment				
	AWQC	SQC	NOAA ER-L	NOAA ER-M	Ontario LEL	Ontario SEL
Maximum	447.5	420.5	13022.9	37.8	165.4	3.8
Mean	61.4	363.6	11269.2	32.8	143.7	3.3

HIs for aquatic receptors indicate a potential risk for aquatic life due primarily to metals (aluminum, cadmium, copper, lead, manganese, and zinc). For sediments, HQs are greater than 1.0 for metals, dieldrin, PAHs, and PCBs.

HIs for terrestrial vegetation at the East Pond Marsh Area are 27.04 and 19.99 for the maximum detected soil concentration and mean detected soil concentration, respectively. Only the maximum and mean concentrations of zinc yielded an HQ greater than 1.0; however, the PAHs and the remaining metals contributed significantly to the overall HI, which exceeded 1.0.

HIs for terrestrial and aquatic wildlife receptors that characterize food chain exposures are listed below: HIs based on both maximum and mean detected soil concentrations exceed the regulatory threshold of 1.0 for all aquatic wildlife species evaluated and for the terrestrial small mammals (i.e., meadow vole and northern short-tailed shrew). HIs for predator species (i.e., northern harrier, short eared owl, and the red fox) are below 1.0 suggesting that bioaccumulation through the food chain from prey to predator is not occurring at an appreciable rate.

Summary of Food Chain Exposure Hazard Indices for Expected Species at the East Pond Marsh Area

Species	HI-Maximum Concentration	HI-Mean COC Concentration
Aquatic Species		
Muskrat	28.6	25.8
Mallard Duck	45.79	39.97
American black duck	47.99	42.86
Black-crowned night heron	129	126
Terrestrial Species		
Meadow vole	2.5	2.2
Northern short-tailed shrew	63.6	51.1
Upland sandpiper	NA	NA
Grasshopper sparrow	NA	NA
White-footed mouse	NA	NA
Northern cardinal	NA	NA
Northern harrier	0.0037	0.0031
Short-eared owl	0.041	0.029
Red Fox	0.0021	0.0017

At the Southern Drainage Ditch, risks to terrestrial vegetation and terrestrial wildlife species were evaluated based on contamination identified in ditch sediments. Because the Southern Drainage Ditch Area receives only intermittent drainage and is dominated by upland or facultative species, ditch sediments were evaluated as "soils." HIs for terrestrial vegetation at the Southern Drainage Ditch are 32.61 and 14.63 for the maximum detected soil concentration and mean detected soil concentration, respectively. The maximum concentrations of antimony, chromium, copper, lead, mercury, vanadium, and zinc had HQs exceeding 1.0. Mean concentrations of copper, lead, and zinc had HQs exceeding 1.0.

HIs for terrestrial wildlife receptors that characterize food chain exposures are listed below. HIs for the northern cardinal were 145.7 and 82.7 for maximum detected concentrations and mean detected concentrations, respectively. These HIs substantially exceed the regulatory threshold of 1.0, which suggests that the omnivorous feeding habits of the cardinal result in increased exposure. HIs for the northern short-tailed shrew (24.3 and 15 maximum detected concentration and mean detected concentration, respectively) were also substantial. The meadow vole and white-footed mouse had HIs (based on maximum detected concentrations) less than 10. Exceedances less than 10 are generally not considered significant indicators of potential ecological effects.

Summary of Food Chain Exposure Hazard Indices for Expected Species at the Southern Drainage Ditch Area

Species	HI—Maximum COC Concentration	HI—Mean COC Concentration
Aquatic Species		
Muskrat	NA	NA
Mallard Duck	NA	NA
American black duck	NA	NA
Black-crowned night heron	NA	NA
Terrestrial Species		
Meadow vole	1.7	1
Northern short-tailed shrew	24.3	15
Upland sandpiper	NA	NA
Grasshopper sparrow	NA	NA
White-footed mouse	2.4	1.5
Northern cardinal	145.7	82.7
Northern harrier	NA	NA
Short-eared owl	NA	NA
Red fox	0.0003	0.00018

At CS-10A and CS-10B, risks to terrestrial vegetation and terrestrial wildlife species were evaluated based on contamination identified in soils and sediment. HIs for terrestrial vegetation at CS-10A and CS-10B are 43.39 and 11.37 for maximum detected soil concentration and mean detected soil concentration, respectively. The maximum concentrations of antimony, cadmium, copper, lead, mercury, and zinc had HQs exceeding 1.0. Mean concentrations of antimony, cadmium, and mercury had HQs exceeding 1.0.

HIs for terrestrial wildlife receptors that characterize food chain exposures are listed below. Except for the northern harrier, short-eared owl, and red fox, which had HIs less than 10 based on maximum detected concentrations, all terrestrial wildlife species evaluated had substantial HIs. HIs ranged from 20.8 to 1,108, which indicates a potential for substantial ecological effects in these species. HIs based on mean detected concentrations were only slightly lower. Using "mean HIs," the meadow vole, with a mean HI of 3.5, would not be expected to be substantially affected by exposure to COCs.

Summary of Food Chain Exposure Hazard Indices for Expected Species at CS-10A and CS-10B

Species	HI ! Maximum COC Concentration	HI ! Mean COC Concentration
Aquatic Species		
Muskrat	NA	NA
Mallard duck	NA	NA

Species	HI—Maximum COC Concentration	HI—Mean COC Concentration
American black duck	NA	NA
Black-crowned night heron	NA	NA
Terrestrial Species		
Meadow vole	20.8	3.5
Northern short-tailed shrew	758.4	209.7
Upland sandpiper	928.2	193.8
Grasshopper sparrow	301.8	60.8
White-footed mouse	97.5	23.8
Northern cardinal	1108	381
Northern harrier	0.3	0.1
Short-eared owl	2	1.1
Red fox	0.2	0.1

On a geographic area basis, the greatest potential of negative food chain effects for both aquatic and terrestrial wildlife species was found in the East Pond Area with maximum and mean contaminant concentration HIs of 129 and 126, respectively. Considering only terrestrial species, the area that poses the greatest potential for negative effects is CS-10A and CS-10B (maximum concentration HIs up to 928), followed by the Southern Drainage (maximum concentration HIs up to 145.7) and East Pond Area (maximum concentration HIs of 63.6).

2.6.2.5 Evaluation of Uncertainties

Uncertainties associated with the ecological PRA are briefly summarized below.

- Concentrations of chemicals in plants and invertebrates were estimated using kinetic models, which estimate the chemical concentrations based on the chemical properties of a substance and its concentrations in the surrounding media. The variability within a biological system often makes it difficult to predict chemical concentrations based on kinetic models.

- There is uncertainty in estimating the intake of contaminants through the various exposure routes (e.g., soil ingestion and food chain bioaccumulation) because actual food consumption, soil ingestion, and respiratory rates of a receptor may not be known or are based on a large range derived from literature values.

- The toxicological parameters used to quantify potential risks to ecological receptors are extrapolated from toxic effects in other animals. Some of these studies were derived from the lowest observed adverse effects level from studies based on laboratory animals. The extrapolation of toxic effects in one species to those in another is offset by an uncertainty factor that is often the product of several uncertainty factors, each intended to account for one type of uncertainty. Thus, a benchmark value may be greater than that for a laboratory study. By reducing the benchmark value for each level of uncertainty, it is likely that the final value is lower than the actual acceptable dose for the receptor.

- A level of uncertainty is also introduced through the selection of receptor species based upon literature reviews identifying species known or expected to occur at the site. Ecological field surveys were not conducted as part of the Tier III analysis. Therefore, it is not known if the selected receptor species actually are present at the site or if a suitable habitat exists to support the receptors.

- An additional level of uncertainty is associated with the toxicity of background soil concentrations of both naturally occurring and anthropogenic compounds. In characterizing the potential risk posed by the site to ecological receptors, it is noted that the compounds with HQs that most influence the final HIs are ubiquitous compounds detected in background samples.

- Uncertainty surrounding the toxicity of background soil concentrations of both naturally occurring and anthropogenic compounds.

2.6.3 Risk Characterization Summary

The PRA was conducted for the CS-10/FS-24 site according to the guidance in the RAH (ASG, Inc., 1994). Data from the confirmatory sampling were not incorporated into the PRA. For the purposes of the PRA, the site was subdivided into three geographic regions: (1) the CS-10A and CS-10B operable units including the waste oil disposal site, (2) the Eastern Drainage Impoundment, and (3) the Southern Storm Sewer Outfall Drainage Ditch. Risks from exposure to soil at CS-10/FS-24 are within or below the USEPA target risk range. However, subsurface soil was not included in the PRA for CS-10/FS-24 because:

- the exposure pathway does not exist or is limited to short duration, and
- concentrations of contaminants found in both surface and subsurface soil are generally greater in the surface soil.

CS-10A and CS-10B. The human health risk assessment concluded that there are no exceedances of the generally accepted USEPA target risk range (10^{-6} to 10^{-4}) in current and future exposure scenarios for exposure to source area surface soils and sediments. However, the MADEP target risk was exceeded at CS-10A and CS-10B for current and future workers and future child residents (ages 1 to 6 and 7 to adult) exposed to sediments. Future exposure to soil by child residents (ages 1 to 6) also exceeded the MADEP target risk. All HIs, a measure of noncarcinogenic effects, for current and future exposure are less than 1.0. However, based on the ecological risk assessment, surface soils pose unacceptable ecological risks from metals, dieldrin, and PAHs.

Eastern Drainage Impoundment. The human health risk assessment concluded that there are no exceedances of the generally accepted USEPA target risk range (1×10^{-6} to 1×10^{-4}) in current and future exposure scenarios for exposure to source area surface soils, sediments, and surface water. However, the MADEP target risk of 1×10^{-5} was exceeded at the Eastern Drainage Impoundment for current and future workers and future child (ages 1 to 6 and 7 to adult) residents exposed to soil. All HIs for current and future exposure are less than 1.0, which indicates that there are no noncancer human health risks. Based on the ecological risk assessment, PAHs, PCBs, dieldrin, and metals in soils and sediments pose unacceptable risks; metals in surface water also exceed acceptable levels.

Southern Storm Sewer Outfall Drainage Ditch. The human health risk assessment concluded that there are no exceedances of the generally accepted USEPA target risk range (1×10^{-6} to 1×10^{-4}) in current and future exposure scenarios for exposure to source area sediments. However, the MADEP target risk of 1×10^{-5} was exceeded at the Southern Storm Sewer Outfall Drainage Ditch for current and future workers and future child residents (ages 1 to 6 and 7 to adult) exposed to sediments. Based on the ecological risk assessment, PAHs, dieldrin, and metals in soils and sediments pose unacceptable risks.

2.7 DEVELOPMENT AND SCREENING OF ALTERNATIVES

Under its legal authorities, AFCEE's primary responsibility at Superfund sites is to undertake remedial actions that are protective of human health and the environment. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences that include (1) a requirement that the remedial action, when complete, must comply with all federal and more stringent state environmental and facility siting standards, requirements, criteria, or limitations unless a waiver is invoked; (2) a requirement that a remedial action be cost-effective and use permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (3) a preference for remedies in which treatment permanently and significantly reduces the toxicity, mobility, or volume of hazardous substances as a principal element. Response alternatives were developed to be consistent with these mandates.

Based on preliminary information relating to types of contaminants, environmental media of concern, and potential exposure pathways and risks, remedial response objectives were developed to aid in developing and screening remedial action alternatives. These remedial response objectives for AOC CS- 10/FS-24 were developed to mitigate existing and future potential threats to human health and the environment. Specifically, these objectives are:

- To minimize direct contact, ingestion, and inhalation by human receptors with Source-Area-contaminated soils/sediments estimated to exceed a total cancer risk level of 10^{-6} for each carcinogenic compound, or exceed STCLs based on human health risk.
- To minimize adverse impacts to ecological receptors from Source-Area-contaminated soils, sediment, and surface water estimated to exceed an HI of 1 or exceed STCLs based on ecological risk.
- To provide a source control alternative that minimizes future migration of contaminants in soils/sediments to the underlying aquifer and to off-site locations as determined by exceedance of STCLs based on leaching.
- To the extent feasible, to reduce the concentration of the inorganic COCs in soils/sediments to achieve or approach STCLs based on background.

CERCLA and the NCP set forth the process by which remedial actions are evaluated and selected. In accordance with these requirements, the FFS developed a range of alternatives that included an alternative in which treatment that reduces the toxicity, mobility, or volume of the hazardous substances is a principal element and removes or destroys hazardous substances to the maximum extent feasible and thereby eliminates or minimizes (to the degree possible) the need for long-term management. This range also included alternatives that involve little or no treatment but provide protection through engineering or institutional controls, and a No Action alternative.

As discussed in Section 3 of the FFS, AFCEE identified, assessed, and screened technologies based on implementability, effectiveness, and cost. The purpose of the initial screening was to narrow the number of potential remedial actions for further detailed analysis while preserving a range of options. Section 4 of the FFS presented the remedial alternatives developed by combining the technologies identified in the previous screening process into the categories identified in Section 300.430(e)(3) of the NCP, and evaluated and screened these alternatives in accordance with Section 300.430(e)(7) of the NCP. All four of the remedial alternatives screened in Section 4 (not including the required No Action alternative) were retained for detailed analysis. The alternatives that were retained are:

Alternative 1: No Action
Alternative 2: Limited Action
Alternative 3: Excavation, On-Site Asphalt Batching and Off-site Disposal/In Situ Thermally Enhanced SVE/Environmental Monitoring
Alternative 4: Excavation and Off-Site Asphalt Batching/In Situ Thermally Enhanced SVE/Environmental Monitoring
Alternative 5: Excavation and Off-site Landfill Disposal/In Situ Thermally Enhanced SVE/Environmental Monitoring

2.8 DESCRIPTION OF ALTERNATIVES

The FFS (HAZWRAP 1998) assessed how well the following five alternatives would address the two principal threats identified at AOC CS-10/FS-24: (l) exposure of human and ecological receptors to surface soil, sediment, and surface water and (2) exposure to contaminated groundwater resulting from potential leaching of VOCs, SVOCs, pesticides, PCBs, inorganics, and TPH compounds into groundwater.

2.8.1 Alternative 1: No Action

The No Action alternative was evaluated as a baseline with which to compare other alternatives. No remedial action, monitoring, further investigation, or 5-year site reviews would be performed as part of this alternative. No action would be taken to maintain site access restrictions (security fencing and military guard posts) that currently limit potential human exposure to site contaminants. State and federal risk management guidelines and applicable or relevant and appropriate requirements (ARARs) would not be met by implementing this alternative. No costs are associated with the no action alternative because no remedial action would take place.

2.8.2 Alternative 2: Limited Action

2.8.2.1 Major Components of the Remedial Alternative

The major components of the Limited Action alternative include environmental monitoring, the use of institutional controls to restrict access to the site, and 5-year reviews. Environmental monitoring would be utilized to monitor contaminant migration and access restrictions—such as deed restrictions, zoning and base master plan alterations and institutional controls such as a covenant restricting groundwater use—would be made to prevent exposure to contamination remaining at the site. This containment strategy is easily implemented, incurs minimal capital cost, and presents a low potential for exposure to contaminants during execution.

2.8.2.2 Residuals/Emissions Management

For the soils at Details G and H, which have very low levels of COCs that do not warrant remedial action, this alternative provides for implementation of a confirmatory sampling plan to determine whether remedial objectives have been met. At the completion of confirmatory sampling, it will be confirmed whether risks to ecological and human receptors exceed risk-based STCLs. If sampling indicates that COC concentrations are below STCLs at Detail G or H, then no further action will be performed at that source area; if COC concentrations are found to exceed STCLs, then further action will be recommended. Estimated time for design and construction is 6 to 12 months. The estimated capital cost of the limited action alternative is $64,554. Estimated operating and maintenance (O&M) costs (present worth) are $546,000, and the estimated total cost is $610,554.

2.8.3 Alternative 3: Excavation, On-Site Asphalt Batching and Off-Site Disposal/In Situ Thermally Enhanced SVE/Environmental Monitoring

2.8.3.1 Major Components of the Remedial Alternative

The major components of this alternative include removal of contaminated surface water from the Eastern Drainage Impoundment at Detail F for disposal at the base wastewater treatment plant or off-site treatment plant; excavation, dewatering (if necessary) and temporary on-site stockpiling of an estimated 3,400 cy of contaminated surface soils and sediments from seven of the nine source areas (Details A through F and I) where concentrations of COCs in the soils and/or sediments exceed STCLs; on-site cold-mix asphalt batching of recyclable excavated surface soils and sediments, and off-site disposal of non-recyclable excavated surface soils and sediments. Confirmatory sampling will be performed during excavation to verify the extent of contamination exceeding STCLs and ensure that all soils and sediments with COC concentrations above such cleanup goals are removed from the source areas. All areas from which contaminated soils and sediments are removed will be backfilled with clean fill. In addition, at Detail C where excavation is impractical because of the depth of contamination (>20 ft bgs) for the in situ thermally enhanced SVE, hot air injection wells, a vapor collection system, and a temporary impermeable cover will be installed. At Details G and H, a confirmatory sampling plan will be implemented. Because the remedy is a source area remedial action, it does not include a groundwater migration management component; however, groundwater monitoring will occur annually for 5 years to support ongoing groundwater investigations, which will be a part of another report. To evaluate the performance of this remedy, 5-year reviews will be conducted at AOC CS- 10/FS-24 to review monitoring and other pertinent data to assess whether the selected remedy remains protective of human health and the environment.

If source area soils and sediments require temporary stockpiling on-site, it will be done in accordance with RCRA (40 CFR Part 264) and state hazardous waste storage regulations (310 CMR 30.640), which are action-specific ARARs for this AOC. In addition, excavated source area soils and sediments will be analyzed by RCRA TCLP (40 CFR Part 261) to determine whether they are characteristic hazardous waste under RCRA. Soils and sediments that are determined to exceed TCLP allowable concentrations or to contain contaminant concentrations above MADEP MCP Method 1 S-l/GW-1 Standards for pesticides or Massachusetts Permitted Soil Recycling Facility Summary Levels will be disposed off-site in a RCRA Subtitle C TSDF. Soils and sediments that are determined to be below TCLP allowable concentrations and to contain contaminant concentrations below MADEP MCP Method 1 S-l/GW-1 Standards for pesticides and Massachusetts Permitted Soil Recycling Facility Summary Levels will be treated at the on-site cold-mix emulsion asphalt-batching plant. Remedial activities will also be conducted to meet the standards for visible emissions [310 *Code of Massachusetts Regulations* (CMR) 7.06]; dust, odor, construction, and demolition (310 CMR 7.09); noise (310 CMR 7.10); and VOCs (310 CMR 7.18). If these standards are exceeded, emissions will be managed through engineering controls.

2.8.3.2 Residuals/Emissions Management

The cold-mix asphalt-batching process will minimize the airborne release of VOCs by using a nonvolatile cold asphalt emulsion product. This method also minimizes particulate emissions and will be accompanied by aggressive dust control measures to minimize particulate emission before batching and afterward. The asphalt paving material generated by the batching process will be used for subpaving of roads and parking lots at MMR. Any stockpiling of paving material will be temporary. Stockpiled material will be covered to prevent exposure.

A cover will be placed over the areas affected by the thermally enhanced SVE to prevent release of volatile constituents. An off-gas collection system will be a component of the SVE system to collect and treat volatile emissions.

For soils at Details G and H, which have very low concentrations of COCs that do not warrant treatment, the confirmatory sampling component of this alternative provides confirmation that remedial objectives have been met. At the completion of confirmatory sampling, it will be confirmed whether risks to ecological and human receptors exceed risk-based STCLs. If sampling indicates that COC concentrations are below STCLs at Detail G or H, then no further actions will be performed at that source area; if COC concentrations are found to exceed STCLs, then further action will be recommended.

At the completion of the remedial action, human health and ecological risks posed by food chain exposure pathways and human health risks from ingestion, dermal contact, and inhalation would be no greater than the chemical-specific risk-based STCLs established to address ecological risks. Meeting these remediation levels for surface soil and sediment COCs will support remedial objectives designed to protect groundwater operable units being investigated separately. The estimated time for design and construction is 6 to 12 months. The estimated capital cost for implementation of this alternative is $746,659. Estimated O&M (present worth) is $550,800. Estimated total cost is $1,397,459.

2.8.4 Alternative 4: Excavation and Off-Site Asphalt Batching/In Situ Thermally Enhanced SVE/Environmental Monitoring

2.8.4.1 Major Components of the Remedial Alternative

The major components of this alternative include removal of contaminated surface water from the Eastern Drainage Impoundment at Detail F for disposal at the base wastewater treatment plant or off-site treatment plant; excavation, dewatering (if necessary) and temporary on-site stockpiling of an estimated 3,400 cy of contaminated surface soils and sediments from seven of the nine source areas (Details A through F and I) where concentrations of COCs in the soils and/or sediments exceed STCLs; confirmatory sampling during excavation to verify the extent of contamination exceeding STCLs and ensure that all soils and sediments with COC concentrations above such cleanup goals are removed from source areas; and transport and processing of contaminated soils and sediments in an off-site cold-mix asphalt-batching plant. All areas from which contaminated soils and sediments were removed will be backfilled with clean fill.

The in situ thermally enhanced SVE system, to be used at Detail C, will remediate soil contamination at depths that prevent safe and economical excavation. The SVE system will consist of hot air injection wells, a vapor collection system, and a temporary impermeable cover. The cover will be used to prevent volatilization of treated contaminants to the atmosphere. At Details G and H, a confirmatory sampling plan will be implemented. Because the remedy is a source area remedial action, it does not include a groundwater migration management component; however, groundwater monitoring will occur annually for 5 years to support ongoing groundwater investigations, which will be a part of another report. To evaluate the performance of this remedy, 5-year reviews will be conducted at AOC CS- 10/FS-24 to review monitoring and other pertinent data to assess whether the selected remedy remains protective of human health and the environment.

If excavated source area soils and sediments require temporary stockpiling on-site, it will be done in accordance with RCRA and state hazardous waste storage regulations, which are action-specific ARARs for this AOC. In addition, excavated source area soils and sediments will be analyzed by TCLP to determine whether they are characteristic hazardous waste under RCRA. Soils and sediments that are determined to exceed TCLP allowable concentrations or to contain contaminant concentrations above MADEP MCP Method 1 S-1/GW-1 Standards for pesticides or Massachusetts Permitted Soil Recycling Facility Summary Levels will be disposed off-site in a RCRA Subtitle C TSDF. Soils and sediments that are determined to be below TCLP allowable concentrations and to contain contaminant concentrations below MADEP MCP Method 1 S-1/GW-1 Standards for pesticides and Massachusetts Permitted Soil Recycling Facility Summary Levels will be treated at the off-site cold-mix emulsion asphalt-batching plant. Remedial activities will also be conducted to meet the standards for visible emissions (310 CMR 7.06); dust, odor, construction, and demolition (310 CMR 7.09); noise (310 CMR 7.10); and VOCs (310 CMR 7.18). If these standards are exceeded, emissions will be managed through engineering controls.

2.8.4.2 Residuals/Emissions Management

The cold-mix asphalt-batching process will minimize the airborne release of VOCs by using a nonvolatile cold asphalt emulsion product. This method also minimizes particulate emission and will be accompanied by aggressive dust control measures to minimize particulate emission before batching during transportation to an off-site batching facility. The asphalt paving material generated by the batching process will be used as a subpaving material. Any stockpiling of paving material will be temporary. Stockpiled material will be covered to prevent exposure. A cover will be placed over the areas affected by the thermally enhanced SVE to prevent release of volatile constituents. An off-gas collection system will be a component of the SVE system to collect and treat volatile emissions.

For soils at Details G and H, which have very low concentrations of COCs that do not warrant treatment, the confirmatory sampling component of this alternative provides confirmation that remedial objectives have been met. At the completion of confirmatory sampling, it will be confirmed whether risks to ecological and human receptors exceed risk-based STCLs. If sampling indicates that COC concentrations are below STCLs at Detail G or H, then no further action will be performed at that source area; if COC concentrations are found to exceed STCLs, then further action will be recommended.

At the completion of the remedial action, human health and ecological risks posed by food chain exposure pathways and human health risks from ingestion, dermal contact, and inhalation would be no greater than the chemical-specific risk-based STCLs established to address ecological risks. Meeting these remediation levels for surface soil and sediment COCs will support remedial objectives designed to protect groundwater operable unit being investigated separately. The estimated time for design and construction is 6 to 12 months. The estimated capital cost for implementation of this alternative is $867,539. Estimated O&M (present worth) is $550,800. Estimated total cost is $1,418,339.

2.8.5 Alternative 5: Excavation and Off-site Landfill Disposal/In Situ Thermally Enhanced SVE/Environmental Monitoring

2.8.5.1 Major Components of the Remedial Alternative

The major components of this alternative include removal of contaminated surface water from the Eastern Drainage Impoundment at Detail F for disposal at the base wastewater treatment plant or an off-site treatment plant; excavation, dewatering (if necessary) and temporary stockpiling of an estimated 3,400 cy of contaminated surface soils and sediments from seven of the nine source areas (Details A through F and I) where concentrations of COCs in the soils and sediment exceed STCLs; confirmation sampling during excavation to verify extent of contamination exceeding STCLs and ensure that all soils and sediments with COC concentrations above such cleanup goals are removed form source areas; segregating and trucking the excavated soils/sediments to an approved landfill; and backfilling excavated areas. All areas from which contaminated soils and sediments are removed will be backfilled with clean fill.

The in situ thermally enhanced SVE system, to be used at Detail C, will remediate soil contamination at depths that prevent safe and economical excavation. The SVE system will consist of hot air injection wells, a vapor collection system, and a temporary impermeable cover used to prevent volatilization to the atmosphere. At Details G and H, a confirmatory sampling plan will be implemented. Because the remedy is a source area remedial action, it does not include a groundwater migration management component; however, groundwater monitoring will occur annually for 5 years to support ongoing groundwater investigations, which will be a part of another report. To evaluate the performance of this remedy, 5-year reviews will be conducted at AOC CS-10/FS-24 to review monitoring and other pertinent data to assess whether the selected remedy remains protective of human health and the environment.

2.8.5.2 Residuals/Emissions Management

All stockpiled-soils and sediments will be covered to prevent erosion or fugitive dust emissions. Vehicles used to transport contaminated soils and sediments to off-site landfills will be covered to prevent fugitive dust emission during transport. A cover will be placed over the areas affected by the thermally enhanced SVE to prevent release of volatile constituents. An off-gas collection system will be a component of the SVE system to collect and treat volatile emissions.

If source area soils and sediments require temporary stockpiling on-site, it will be done in accordance with RCRA and state hazardous waste storage regulations, which are action-specific ARARs for this AOC. In addition, excavated source area soils and sediments will be analyzed by TCLP to determine whether they are characteristic hazardous waste under RCRA. Soils and sediments that are determined to exceed TCLP allowable concentrations and therefore be hazardous will be disposed off-site in a RCRA Subtitle C TSDF. Soils and sediments that are determined to be below TCLP allowable concentrations and therefore nonhazardous (and that are determined to contain contaminant concentrations below MADEP MCP Method 1 S-1/GW-1 Standards for pesticides) will be disposed off-site in a RCRA Subtitle D TSDF. Remedial activities will also be conducted to meet the standards for visible emissions (310 CMR 7.06); dust, odor, construction, and demolition (310 CMR 7.09); noise (310 CMR 7.10); and VOCs (310 CMR 7.18). If these standards are exceeded, emissions will be managed through engineering controls.

For soils at Details G and H, which have very low concentrations of COCs that do not warrant treatment, the confirmatory sampling component of this alternative provides confirmation that remedial objectives have been met. If sampling indicates that COC concentrations are below STCLs at Detail G or H, then no further action will be performed at hat source area; if COC concentrations area found to exceed STCLs, then further action will be recommended.

At the completion of the remedial action, ecological risks posed by food chain exposure pathways and human health risks from ingestion, dermal contact, and inhalation would be no greater than the chemical-specific risk-based STCLs established to address human health and ecological risks. Meeting these remediation levels for surface soil and sediment COCs will support remedial objectives (i.e., leaching prevention) designed to protect the groundwater operable unit being investigated separately. The estimated time for design and construction is 6 to 12 months. The estimated capital cost for implementation of this alternative is $715,779. Estimated O&M (present worth) is $550,800. Estimated total cost is $1,266,579.

2.9 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

2.9.1 Alternative Evaluation Criteria

Section 121(b)(1) of CERCLA presents several factors that, at a minimum, AFCEE is required to consider in its assessment of remedial action alternatives. Building upon these specific statutory mandates, the NCP specifies nine evaluation criteria that fall into three categories (threshold, balancing, and modifying criteria) that are to be used in assessing the individual remedial alternatives. The nine criteria are used to compare the alternatives and select a remedy that meets the goals of protecting human health and the environment, maintaining protection over time, and minimizing untreated waste. Definitions of the nine criteria are provided below.

2.9.1.1 Threshold Criteria

Each of the two threshold criteria described below must be met for an alternative to be eligible for selection in accordance with the NCP. These are considered threshold criteria because they establish the minimum requirements that a remedial alternative must achieve.

- <u>Overall Protection of Human Health and the Environment</u> This criterion assesses whether a remedy will protect human health and the environment and includes an assessment of how human health and environmental risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

- <u>Compliance with Applicable or Relevant and Appropriate Requirements</u> This criterion assesses whether a remedy complies with all federal and more stringent state environmental and facility-siting laws and requirements that apply or are relevant and appropriate to the conditions and cleanup options at a specific site. If an alternative cannot meet an ARAR, the analysis of the alternative must provide the rationale for invoking a statutory waiver.

2.9.1.2 Primary Balancing Criteria

The following five criteria are used to compare and evaluate the alternatives that meet the threshold criteria. A remedial action is not required to meet all five of these criteria; however, the remedial action should strive to meet as many of these criteria as possible. The effectiveness of a remedial action in achieving these criteria may sway favor toward one alternative or another. These criteria provide a preliminary evaluation of the extent to which the alternative employs permanent solutions and treatment in a cost-effective manner to achieve the site remedial action objective.

- <u>Long-Term Effectiveness and Permanence</u> This criterion assesses the effectiveness of the alternative in protecting human health and the environment after response objectives have been met. In addition, it includes consideration of the magnitude of residual risks and the adequacy and reliability of controls.

- <u>Reduction of Toxicity, Mobility, or Volume Through Treatment</u> This criterion evaluates the effectiveness of treatment technologies used to reduce toxicity, mobility, or volume of hazardous substances. It also considers the degree to which treatment is irreversible and the type and quantity of residuals remaining after treatment. SARA emphasizes that, whenever possible, a remedy should be selected that uses treatment to permanently reduce the toxicity of contaminants at the site, the spread of contaminants away from the source of contamination, and the volume or amount of contamination at the site.

- Short-Term Effectiveness This criterion evaluates the effectiveness of the alternative in protecting human health and the environment during the construction and implementation of a remedy until response objectives have been met. It considers the protection of the community, workers, and the environment during implementation of remedial actions.

- Implementability This criterion assesses the technical and administrative feasibility of an alternative and availability of required goods and services. Technical feasibility considers the ability to construct and operate a technology and its reliability, the ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of a remedy. Administrative feasibility considers the ability to obtain approvals from other parties or agencies and the extent of required coordination with other parties or agencies.

- Cost This criterion evaluates the capital and operation and maintenance costs of each alternative.

2.9.1.3 Modifying Criteria

The modifying criteria are used in the final evaluation of remedial alternatives, generally after AFCEE has received public comments on the FFS report and Proposed Plan.

- State Acceptance This criterion considers the state's preferences among or concerns about the alternatives, including comments on ARARs or the proposed use of waivers.

- Community Acceptance This criterion considers the community's preferences among, or concerns about, the alternatives.

Following the detailed analysis of each individual alternative, AFCEE performed a comparative analysis focusing on the relative performance of each alternative with respect to the nine evaluation criteria. The purpose of the comparative analysis was to identify the advantages and disadvantages of the alternatives relative to one another and to aid in the eventual selection of a remedial alternative for soil, sediment, and/or surface water at each of the nine details at CS-10/FS-24. A detailed analysis of the alternatives using the evaluation criteria is provided in the FFS report (HAZWRAP 1998).

2.9.2 Comparative Analysis of Alternatives

The following sections summarize the comparative analysis of alternatives performed in the FFS for AOC CS-10/FS-24.

2.9.2.1 Overall Protection of Human Health and the Environment

The No Action alternative is not considered protective of human health. It does not provide any reduction in human health and ecological risks because contaminated surface soils, sediments, and surface waters would not be removed or altered. In addition, potential leaching of contaminants to groundwater would not be prevented. Unlike the No Action alternative, the Limited Action alternative would provide access restrictions (fences and warning signs) to limit potential future exposure. However, like the No Action alternative, it does not provide any reduction in ecological risks because contaminated surface soils, sediments, and surface waters would not be removed or altered. In addition, potential leaching of contaminants to groundwater would not be prevented.

In comparison, all three excavation/SVE alternatives provide adequate protection for human health by preventing ingestion of surface soils and leaching of contaminants to the groundwater. These alternatives are fully protective of the environment because they remove or treat the contaminated surface soils, sediments, and surface water. There is no substantive difference in the overall protection of human health and the environment of these three alternatives.

2.9.2.2 Compliance with Applicable or Relevant and Appropriate Requirements

Tables 2-16 through 2-18, Appendix B, summarize the chemical-specific, location-specific, and action-specific ARARs developed in the FFS for CS-10/FS-24. Each category of ARARs is discussed further with respect to the capability of the alternatives to attain these criteria.

No chemical-specific ARARs were identified for AOC CS-10/FS-24. However, CSFs and noncarcinogenic RfDs used in the context of estimating human health risks for the development of STCLs are to-be-considered criteria. All three excavation/SVE alternatives would meet the STCLs by removing and treating or disposing of the contaminated surface soils, sediments, and surface waters in Details A through F and I in accordance with regulatory requirements. These alternatives would not remove or treat the contaminants in Details G and H; however, because Details G and H have very low concentrations of COCs that do not warrant treatment, confirmatory sampling is expected to confirm that risk-based STCLs have been met. If sampling indicates that COC concentrations are below STCLs at Detail G or H, then no further action will be performed at hat source area; if COC concentrations are found to exceed STCLs, then further action will be recommended.

Two state and two federal location-specific ARARs were identified for CS-10/FS-24. The Massachusetts Endangered Wildlife and Wild Plants regulations (321 CMR 8.00) are considered applicable because the state of Massachusetts has the authority to protect any listed species and may require action to do so at AOC CS-10/FS-24 if such a species is threatened by contamination or remedial actions. To ensure protection of the listed species addressed by this applicable regulation, state endangered and threatened species will be surveyed and identified. Their presence, or the presence of their significant critical habitat, will be factored into remedial design considerations under the three excavation/SVE alternatives.

Executive Order 11990 (40 CFR Part 6, Appendix A) establishes that federal agencies are required to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. No remedial alternatives can adversely affect a wetland if other practicable alternatives are available. The Massachusetts Wetlands Regulations (310 CMR 10.00) apply to all activities that will remove, fill, dredge, or alter any inland and coastal wetland subject to protection or alter a buffer zone within 100 feet of such areas. Excavation of contaminated soils and sediments associated with the excavation/SVE alternatives will be performed to minimize adverse effects on wetlands in the vicinity of the Eastern Storm Sewer Outfall Drainage Ditch (Detail E). Any portion of these wetlands adversely affected will be restored or replaced. No activities will take place as part of the No Action and Limited Action alternatives that will result in destruction, loss, or degradation of identified wetlands. However the presence of metals posing an ecological risk to aquatic ecological receptors may contribute to degradation of identified wetlands.

An additional applicable federal location-specific ARAR is the Clean Water Act (CWA) Section 404(b)(I), Guidelines for Specifications of Disposal Sites for Dredge or Fill Material (33 USC 1344; 33 CFR Parts 320-323; 40 CFR Part 230), which regulates the discharge of dredged or fill material in United States waters (including wetlands). No discharge of dredged or fill materials is permitted if practicable alternatives that would have less negative impact on the wetland are available. The excavation alternatives will employ methods that will mitigate negative impacts on the wetlands in the vicinity of the Eastern Storm Sewer Outfall Drainage Ditch (Detail E) and any negatively affected wetland will be restored or replaced. No activities will take place as part of the No Action and Limited Action alternatives that will result in discharge of dredge or fill material.

Five applicable action-specific ARARs were identified for AOC CS-10/FS-24. RCRA requirements include federal RCRA standards for owners and operators of hazardous waste TSDFs (40 CFR Part 264) and identification and listing of hazardous wastes (40 CFR 261.24). These apply to the excavation/SVE alternatives. For these alternatives, source area soils and sediments will be temporarily stockpiled on-site in accordance with RCRA and the state hazardous waste storage regulations. Excavated source area soils and sediments will be analyzed by TCLP to determine whether they are characteristic hazardous waste under RCRA. Soils and sediments that are determined to exceed TCLP allowable concentrations or to contain contaminant concentrations above MADEP MCP Method 1 S-1/GW-1 Standards for pesticides or Massachusetts Permitted Soil Recycling Facility Summary Levels will be disposed off-site in a RCRA Subtitle C TSDF. Soils and sediments that are determined to be below TCLP allowable concentrations and to contain contaminant concentrations below MADEP MCP Method 1 S-1/GW- 1 Standards for pesticides and Massachusetts Permitted Soil Recycling Facility Summary Levels will be treated at the on-site cold-mix emulsion asphalt-batching plant.

The CWA National Pollution Discharge Elimination System (NPDES) regulations (33 USC 1342; 40 CFR Parts 122-125, 131, and 136) specify the permissible concentration or level of contaminants in the discharge from any point source, including the channeling of site runoff. Remedial activities for the excavation/SVE alternatives will be controlled to meet NPDES discharge requirements, including requirements for surface and storm water runoff. The No Action and Limited Action alternatives will not produce point source runoff or runoff from channeling.

The Massachusetts Air Pollution Control Regulations (310 CMR 7.00) set emission limits necessary to attain ambient air quality standards. Remedial activities under three excavation/SVE alternatives will be conducted to meet the standards for visible emissions (310 CMR 7.06); dust, odor, construction, and demolition (310 CMR 7.09); noise (310 CMR 7.10); and VOCs (310 CMR 7.18). If these standards are exceeded, emissions will be managed through engineering controls.

MADEP's Interim Remediation Waste Policy for Petroleum Contaminated Soils (WSC-94-400) outlines management practices for reuse, recycling, disposal, storage, and transport of petroleum-contaminated soils. Excavated source area soils and sediments will be analyzed to determine whether they contain contaminant concentrations below the Massachusetts Permitted Soil Recycling Facility Summary Levels set out in this policy. Soils and sediments that are determined to contain contaminant concentrations above these Permitted Soil Recycling Facility Summary Levels will be disposed off-site in a licensed TSDF. Soils and sediments that are determined to contain contaminant concentrations at or below these levels (and that are determined to be below RCRA TCLP allowable concentrations and to contain contaminant concentrations below MCP Method 1 S-1/GW- 1 Standards for pesticides) will be treated at the on-site cold-mix emulsion asphalt-batching plant

2.9.2.3 Long-Term Effectiveness and Permanence

The No Action alternative does not offer long-term effectiveness at protecting human health or the environment. The Limited Action alternative includes access restrictions but does not include treatment measures to protect groundwater quality, and, therefore, does not offer long-term effectiveness to protect human health and the environment.

The treatment and removal of soils for recycling or disposal in a lined landfill in all three excavation/SVE alternatives would leave residual risks of less than 1×10^{-6}. These alternatives provide long-term effectiveness and permanence of treatment/disposal.

2.9.2.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Neither the No Action nor Limited Action alternative provides treatment to reduce the toxicity, mobility, or volume of contaminants. Certain components of each of the three excavation/SVE alternatives would meet the CERCLA preference for treatment. On-site asphalt batching provides a reduction in mobility. Disposal in a lined landfill would reduce mobility although no treatment is provided. SVE provides reduction in volume of contaminants and reduction of toxicity through degradation of the organic compounds.

2.9.2.5 Short-Term Effectiveness

The Excavation, On-Site Asphalt Batching and Off-site Disposal/In Situ Thermally Enhanced SVE/Environmental Monitoring, Excavation and Off-Site Asphalt Batching/In Situ Thermally Enhanced SVE/Environmental Monitoring, and Excavation and Off-site Landfill Disposal/In Situ Thermally Enhanced SVE/Environmental Monitoring alternatives that incorporate in situ SVE provide adequate short-term effectiveness. Measures to control potential releases during excavation, asphalt batching, and stockpiling of soils or asphalt minimize exposure to workers and the surrounding community by preventing opportunities for exposure to occur. Potential inhalation risks to workers and the surrounding community generated from the excavation, stockpiling, and treatment activities are controlled by implementing routine dust suppression measures used during all remedial actions of this type (e.g., wetting and/or covering of soils). Cold-mix asphalt batching has been chosen specifically to reduce airborne emissions. Volatile emissions are not likely to represent an exposure concern for the surrounding community because of the communities expected distance from the batching facility, the use of a "cold" process, and the lack of volatile compounds in the asphalt emulsion.

Off-gas treatment systems and a cover over the area of remediation will ensure short-term effectiveness during in situ SVE. The cover will prevent contaminant volatilization, and the off-gas treatment system will control releases of contaminants into the atmosphere, thus preventing exposure to both workers and the general public. Monitoring will occur during the SVE process to ensure that the off-gas treatment system, operates within acceptable performance standards that prevent release of COCs into the atmosphere. Erosion, which also mobilizes contaminants, will be limited by erosion-control measures (e.g., hay bales and erosion fences), thus limiting contaminant migration.

With respect to workers, monitoring combined with health and safety protocols will prevent appreciable exposure during implementation of the excavation remedies and will provide an added measure of protection for the surrounding community. Effects on potential ecological receptors are not expected. Significant portions of ecosystem habitat will not be affected by the remedial action to such a degree that organisms will be permanently displaced. Erosion control measures will contain the affected area to prevent additional ecosystem effects. Exposure via the food chain and direct contact exposure pathways for ecological receptors is not expected to be increased during implementation because receptors would not be exposed to concentrations of contaminants at levels exceeding those modeled in the ecological PRA.

The Excavation and Off-site Landfill Disposal/In Situ Thermally Enhanced SVE/Environmental Monitoring alternative provides adequate short-term effectiveness. Measures to control potential releases during excavation will minimize exposure to workers and the surrounding community in the same manner, for the same risks, and using the same methods as those described above for the excavation/asphalt batching/treatment alternatives. This is the case because factors affecting exposure for short-term effectiveness considerations are primarily associated with excavation and stockpiling of surface soil. Asphalt-batching activities involve the same or similar exposure pathways and are controlled through the same monitoring and mitigation measures used for excavation activities. The only difference is the process that generates potential releases and the additional temporary stockpiling of asphalt.

Confirmatory sampling at Details G and H is a component of all the alternatives except the No Action alternative. Confirmatory sampling is protective of human health and the environment in the short term when combined with the excavation and treatment alternatives because if confirmatory sampling identifies concentrations of COCs exceeding cleanup levels, further action will be required to clean up Details G and H.

The Limited Action alternative, which involves only confirmatory sampling, is not effective in the short term because it does not prevent exposure to ecological receptors or prevent potential leaching to groundwater.

Implementation of the No Action alternative is immediate and requires no engineering activities. Therefore the short-term effectiveness criteria has little applicability in this situation. In the short-term, risk to potential human and ecological receptors would not be affected beyond what has been estimated in the PRA. No measures would be taken to reduce or control those risks in the short-term.

2.9.2.6 Implementability

There is no implementability problem with the No Action alternative because of its nature. The only implementation involved with the Limited Action alternative is the installation of fencing at Details D, E, and F, which is easily constructed. The three excavation alternatives involve readily available materials, equipment, and services that are easily implemented.

2.9.2.7 Cost

Since the issuance of the CS- 10/FS-24 FFS, the cost for the alternatives has been revised. The revised cost for each alternative are presented in Appendix. Cost includes the capital (up-front) cost of implementing an alternative and the long-term cost of operating and maintaining the alternative. Capital and O&M costs for each alternative were calculated with an estimated accuracy of -30% to +50%. The alternatives with the lowest capital costs are those that include the least amount of construction, such as the No Action and Limited Action alternatives. O&M costs were estimated on an annual basis and are lowest for the No Action alternative, -which does not provide any long-term maintenance or monitoring.

The Total Cost (present worth) Limited Action alternative is less costly than the three excavation/SVE alternatives at $0.3 million. The other alternatives including the excavation off-site landfill disposal alternative will cost approximately $1.4 million.

To enable comparison of costs that will occur over different time periods, the present worth of capital and O&M costs was also calculated. The following table compares capital, O&M, and presentworthcosts for each alternative evaluated in detail for AOC CS- 10/FS-24.

Alternative	Total Capital Cost	Total O&M (Present Worth)	Total Costs (Present Worth)
No Action	$0	$0	$0
Limited Action	$64,554	$546,000	$600,554
Excavation, On-Site Asphalt Batching and Off-site Disposal/In Situ Thermally Enhanced SVE/Enviromental Monitoring	$746,659	$550,800	$1,397,459

Alternative	**Total Capital Cost**	**Total O&M (present Worth)**	**Total Costs (Present Worth)**
Excavation and Off-Site Asphalt Batching/In Situ Thermally Enhanced SVE/Enviromental Monitoring	$867,539	$550,800	$1,418,339
Excavation and Off-site Landfill Disposal/In Situ Thermally Enhanced SVE/Enviromental Monitoring	$715,779	$550,800	$1,366,579
Excavation, Off-site Asphalt Batching, and Off-site Landfill Disposal/In Situ Thermally Enhanced SVE/Enviromental Monitoring	$729,099	$550,800	$1,379,899

Based on an evaluation provided by USEPA, the last entry in the above table represents the remedial costs assuming that 77% to 100% of site soils excavated from Details A, D, E, and F are likely to fail the allowable criteria for the asphalt-batching treatment technology. If the soils and sediments excavated from Details A, D, E, and F exceed TCLP allowable concentrations or contain contaminant concentrations above MADEP MCP Method 1 S- 1 /GW- 1 Standards for pesticides or Massachusetts Permitted Soil Recycling Facility Summary Levels, thus requiring off-site disposal, then the remaining soils from Details B and I will require off-site asphalt batching because the soil volumes will be too small to economically justify on-site asphalt batching. As such, the costs presented in the table addresses the capital costs for excavation and off-site asphalt batching for Details B and 1, off-site disposal for Details A, D, E, and F, in-situ thermally enhanced SVE for Detail C, and environmental monitoring. The backup cost summary information can be found in Appendix G along with the revised cost of the other alternatives. The evaluation of this scenario shows that the cost would only be marginally greater than the excavation and off-site landfill disposal cost.

2.9.2.8 State Acceptance

The Commonwealth of Massachusetts has reviewed the RI report, FFS report, and the Proposed Plan, and concurs with AFCEE's selected remedy.

2.9.2.9 Community Acceptance

During the public comment period, 100 comments on the Proposed Plan were received from 14 commentators. Six of the commentators expressed either favor or disapproval for the preferred alternative, Excavation, On-Site Asphalt Batching and Off-site Disposal/In Situ Thermally Enhanced SVE/Environmental Monitoring. The remaining comments were varied and grouped into 17 subject categories. Four main topics were of most concern: (1) interest in the investigation results; (2) requests for assurances from AFCEE that proper health and safety measures would be enacted during the implementation of the proposed alternative, particularly concerning air quality monitoring; (3) concerns about the possibility of health risks that might arise during asphalt batching; and (4) questions asking for clarification of the asphalt-batching process.

In addition, several commentators requested an extension of the public comment period so that additional information could be disseminated to the public. As discussed previously in this ROD, the public comment period was extended 30 days and a fact sheet that addressed cold-mix asphalt batching was distributed.

A Responsiveness Summary that addresses all comments received at the Public Hearing and that were provided during the public comment period is provided in Appendix C. All correspondence received from the public is included as an attachment to the Responsiveness Summary (Appendix C. The transcript of the Public Hearing is provided in Appendix D.

2.10 DESCRIPTION OF THE SELECTED REMEDY

The selected remedy for AOC CS-10/FS-24 is Excavation, On-site Asphalt Batching, and Off-site Disposal/In Situ Thermally Enhanced SVE/Environmental Monitoring. The major components of this alternative include removal of contaminated surface water from the Eastern Drainage Impoundment at Detail F for disposal at the base wastewater treatment plant or off-site treatment plant; excavation, dewatering (if necessary) and temporary on-site stockpiling of an estimated 3,400 cy of contaminated surface soils and sediments from seven of the nine source areas (Details A through F and I) where COC concentrations in the soils and/or sediments exceed STCLs; on-site cold-mix asphalt batching of recyclable excavated surface soils and sediments; and off-site disposal of nonrecyclable excavated surface soils and sediments. Confirmatory sampling will be performed during excavation to verify the extent of contamination exceeding STCLs and ensure that all soils and sediments with COC concentrations above such cleanup goals are removed from the source areas. All areas from which contaminated soils and sediments are removed will be backfilled with clean fill. In addition, at Detail C for the in situ thermally enhanced SVE, hot air injection wells, a vapor collection system and a temporary impermeable cover will be installed. At Details G and H, a confirmatory sampling plan will be implemented. Because the remedy is a source area remedial action, it does not include a groundwater migration management component; however, groundwater monitoring will occur annually for 5 years to support ongoing groundwater investigations, which will be a part of another report. To evaluate the performance of this remedy, 5-year reviews will be conducted at AOC CS- 10/FS-24 to review monitoring and other pertinent data to assess whether the selected remedy remains protective of human health and the environment.

If source area soils and sediments require temporary on-site stockpiling, it will be done in accordance with RCRA (40 CFR Part 264) and state hazardous waste storage regulations (310 CMR 30.640), which are action-specific ARARs for this AOC. In addition, excavated source area soils and sediments will be analyzed by the RCRA Toxicity Characteristic Leaching Procedure (TCLP)

(40CFR Part 261) to determine whether they are characteristic hazardous waste under RCRA. Soils and sediments that are determined to exceed TCLP allowable concentrations or to contain contaminant concentrations above MADEP MCP Method 1 S-1/GW-1 Standards for pesticides or Massachusetts Permitted Soil Recycling Facility Summary Levels will be disposed off-site in a RCRA Subtitle C TSDF. Soils and sediments that are determined to be below TCLP allowable concentrations and contain contaminant concentrations below MADEP MCP Method 1 S-1 /GW-1 Standards for pesticides and Massachusetts Permitted Soil Recycling Facility Summary Levels will be treated at the on-site cold-mix emulsion asphalt-batching plant. Remedial activities will also be conducted to meet the standards for visible emissions (310 CMR 7.06); dust, odor, construction, and demolition (310 CMR 7.09); noise (310 CMR 7.10); and VOCs (310 CMR 7.18). If these standards are exceeded, emissions will be managed through engineering controls. The locations of the nine source areas proposed for remedial action at AOC CS- 10/FS-24 are illustrated in Figure 2-4, Appendix A.

In addition, as part of the remedial design, it will be determined whether additional remedial action is warranted with regard to the Building 4606 drainage structures, including but not limited to removal of the drainage structures and all contaminated liquids in the structures, an investigation to determine the source of contamination in the structures and characterize any soil contamination associated with the structures, and excavation and/or treatment of any contaminated soils.

2.10.1 Cleanup Levels

Based on data and information presented in the RI, the PRA, and summarized in the FFS report, remedial actions to address human health and ecological risks associated with possible exposure to source area soils and sediments at AOC CS-10/ FS-24 are warranted based on expected future land use. At CS-10A and CS-10B, the human health risk assessment concluded that the MADEP target risk was exceeded for current and future workers and future residents (ages 1 to 6 and 7 to adult) exposed to sediments and future child residents (ages 1 to 6) exposed to soil. In the ecological PRA, surface soils were identified as posing an unacceptable risks from metals, dieldrin, and PAHs. At the Eastern Drainage Impoundment, the MADEP target risk was exceeded for current and future workers and future residents (ages 1 to 6 and 7 to adult) exposed to soil. PAHs, PCBs dieldrin, and metals in soils and sediments pose unacceptable ecological risks, and metals in surface water also exceed acceptable levels. At the Southern Drainage Ditch, the MADEP target risk was exceeded for current and future workers and future residents (ages 1 to 6 and 7 to adult) exposed to sediments.Based on the ecological risk assessment, PAHs, dieldrin, and metals in soils and sediments pose unacceptable risks.

STCLs developed for the DSRP at MMR were used as target cleanup levels for the AOC. The STCLs were developed to be protective of human health and the environment, and they are considered applicable to the AOC addressed in this ROD. Separate listings are provided for organics with a water organic-carbon partition coefficient (K_{oc}) of less than 1,000 (i.e., those considered to have potential to leach to groundwater), organics with a K_{oc} greater than 1,000, and inorganics. The STCLs for protection of human health differentiate between potential receptor exposures based on contaminant depth (0 to 2 feet bgs for surface exposure and 0 to 15 feet bgs for surface exposure). These assumptions are based on reduced potential for exposure at greater depths. The STCLs for protection of ecological receptors are based only on exposure to soil with a depth of 0 to 2 feet bgs.

The STCLs for inorganics were, in general, set equal to the lowest of the following four risk-based concentration values.

- For human health, concentrations were back-calculated to represent a 1 x 10^{-6} cancer risk under the MMR RAH (ASG 1994) Tier I exposure assumptions.

- For human health, concentrations were back-calculated to represent a noncancer HQ of 0.2 under the MMR RAH Tier I exposure assumptions (an HQ of 0.2 was selected consistent with the RAH to account for potential synergistic and additive effects of exposure to multiple contaminants).

- For ecological receptors (mammals), the lowest of the HECs was calculated for each of five indicator species (mouse, vole, shrew, fox, and muskrat) under the MMR RAH Tier I and II exposure assumptions.

- For ecological receptors (birds), the lowest of the HECs were calculated for each of eight indicator species (sandpiper, sparrow, harrier, owl, mallard duck, black duck, night heron, and cardinal) under the MNM RAE Tier I and II exposure assumptions.

Tables 2-2 through 2-11 provide the STCLs used for the COCs identified at Details A through I. Except where noted, the above criteria were used to select STCLs. Exceptions are noted in the tables. Exceptions include the use of background concentrations, MCP S-1/GW-1 Standards, and calculated soil contaminant leaching values. These values were employed as consistent with methods specified in the RAE and the STCLs document (Jacobs Engineering Group 1995).

Based on the foregoing approach, the use of the DSRP STCLs as target cleanup concentrations is considered protective of human health and the environment at MMR. The following procedure, based on the DSRP STCL document (Jacobs Engineering Group 1995), was used to identify soil cleanup levels for the AOC.

If the PRA did not identify human health or ecological soil exposure risk greater than USEPA risk management guidelines, detected organics with a K_{oc} of less than 1,000 were compared to leaching-based STCLs. Because leaching may occur at any depth, all AOC soil data were considered in this comparison regardless of sample depth. TPH data were compared to an STCL of 500 parts per million (ppm).

If the PPA identified human health or ecological soil exposure risk, detected organics with a K_{oc} of less than 1,000 were compared to leaching-based STCLs, as described for the no-identified-risk example. For other organics and inorganics, available data were compared to the appropriate STCL based on depth and whether the PRA identified potential human health or ecological risk. TPH data were compared to an STCL of 500 ppm.

For the no-identified-risk and identified-risk examples, if the data comparison showed that a contaminant concentration exceeded the STCL, then the STCL was selected as the soil cleanup level for the contaminant and was included in the remedial action objective. If no STCL exceedances were noted, soil was no longer considered a medium of concern, and a corresponding remedial action objective was not developed.

All soils and sediments at AOC CS-10/FS-24 that contain COCs at concentrations exceeding STCLs will be excavated. STCLs will be met when laboratory analyses of samples collected from the sides and bottom of the excavated areas at the AOC confirm the removal of all soils and sediments containing COCs at concentrations exceeding STCLs. Excavation will continue until STCLs are met.

The STCLs are applicable to AOC CS-10/FS-24 as addressed in this ROD because they are consistent with ARARs, attain USEPA's risk management goals for remedial action, and have been determined by AFCEE and USEPA to be protective. These cleanup levels must be met at the completion of the remedial action.

2.10.2 Description of Remedial Components

The selected remedy for AOC CS-10/FS-24 is Alternative 3: Excavation and On-Site Asphalt Batching and Off-site Disposal/In Situ Thermally Enhanced SVE/Environmental Monitoring.

At the completion of the remedial action, the selected remedy will have addressed the principal threats identified at AOC CS-10/FS-24: (1) human and ecological receptor exposure to surface soil, sediment, and surface water and (2) exposure to contaminated groundwater resulting from potential leaching of VOCs, SVOCs, pesticides, PCBs, inorganics, and TPH compounds into groundwater. Ecological risks posed by food chain exposure pathways and human health risks from ingestion, dermal contact, and inhalation will be no greater than the chemical-specific risk-based STCLs established to address human health and ecological risks. Meeting these remediation levels for surface soil and sediment COCs will support remedial objectives designed to support evaluation of the groundwater operable unit being investigated separately.

The major components of the selected remedy are:

- Mobilization and site preparation.
- Removal of contaminated surface water from the Eastern Drainage Impoundment at Detail F for disposal at the base wastewater treatment plant or an off-site treatment plant.
- Confirmation soil/sediment sampling to confirm the horizontal and vertical distribution of COCs exceeding STCLs.
- Excavation, dewatering (if necessary) and temporary on-site stockpiling of contaminated surface soils and sediments from Details A through F and I where concentrations of COCs exceed STCLs.
- Analysis of samples of excavated soils and sediments to determine if COC concentrations exceed RCRA TCLP allowable concentrations, MADEP MCP Method S-1/GW-1 Standards for pesticides or Massachusetts Permitted Soil Recycling Facility Summary Levels.
- Transportation of excavated soil and sediment that are determined to be below RCRA TCLP allowable concentrations and to contain contaminant concentrations below MADEP MCP Method S-1/GW-1 Standards for pesticides and Massachusetts Permitted Soil Recycling Facility Summary Levels to an on-site asphalt batching facility for treatment.
- Off-site disposal at a RCRA Subtitle C TSDF of excavated soils and sediments that are determined to be above RCRA TCLP allowable concentrations or to contain contaminant concentrations above MADEP MCP Method S-1/GW-1 Standards for pesticides and Massachusetts Permitted Soil Recycling Facility Summary Levels

mix emulsion asphalt batching plant. Based on the analytical data in the RI report, USEPA estimates that approximately 92% of the total volume (3,131.6 cy) excavated will not be able to be asphalt batched. A factsheet explaining the asphalt-batching treatment process is included in Appendix F. Details of the asphalt-batching treatment process and associated testing will be presented in a RAWP and/or design plans and specifications to be reviewed and approved by USEPA and MADEP before implementation.

Collecting postexcavation confirmation samples from the excavation perimeter. Confirmation samples will be collected from the perimeter of the excavations (following excavation) and analyzed for the COCs identified at AOC CS-10/FS-24 to confirm that all surface soil and sediments with COC concentrations exceeding STCLs for those COCs have been removed. STCLs will be met when laboratory analysis of samples collected from the sides and bottom of the excavation confirm removal of all soils and sediments containing COCs above STCLs.

Backfilling and restoration excavations with clean borrow material. Following completion of excavation activities, the excavations will be backfilled and restored to original grade with clean fill material. Details of backfill/restoration activities will be presented in a RAWP and/or design plans to be reviewed and approved by USEPA and NLADEP prior to implementation.

Using the asphalt-emulsion-coated product as a paving subgrade material at MMR. Asphalt-batched material will be used as paving subgrade material at selected locations at MMR. A minimum 1-1/2-inch wear coat will be placed over the asphalt-batched material.

In situ SVE. The purpose of the SVE is to clean up COCs detected in subsurface soils below a depth where excavation can be conducted safely. The system consists of:

- installing hot air injection wells, a vapor collection system, and a temporary impermeable cover at the applicable source area;
- setting up and operating a mobile, thermally enhanced SVE system consisting of an air blower/burner to inject hot air and an off-gas treatment system; and,
- performing confirmatory sampling to ensure cleanup goals are achieved.

The SVE system operates by applying a vacuum and removing vapors from an extraction well. This induces vapor flow through the unsaturated zone causing contaminants to volatilize from the soil where they are removed by the carrier gas flow. The three main factors that control the performance of SVE are the contaminant composition, vapor flow rates through the unsaturated zone, and the characteristics of the vapor flow relative to the location of the contaminants.

Maintaining site access controls that limit potential human exposure to contaminants. To limit potential human exposure to site-related contaminants, AFCEE will maintain site access restrictions that are consistent with current security measures. Engineered controls such as fences will be inspected and maintained/repaired not less than annually. If AFCEE can demonstrate, based on currently available or newly acquired data, that site access restrictions can be relaxed or removed while protection of human health and the environment are maintained, AFCEE may petition USEPA for such a relaxation or removal of restrictions. If the CS-10/FS-24 property is transferred out of federal ownership, the United States will impose appropriate enforceable land use restrictions through the inclusion of appropriate restrictions (e.g., restrictive covenants and/or easements) in all deeds or other transfer documents relating to that property.

Confirmatory sampling. For soils at Details G and H, which have very low concentrations of COCs that do not warrant treatment, the confirmatory sampling component of this alternative provides confirmation that remedial objectives have been met. At the completion of confirmatory sampling, it will be confirmed whether risks to ecological receptors exceed risk-based STCLs and leaching criteria protective of human health. If sampling indicates that COC concentrations are below STCLs at Details G or H, then no further action will be performed at that source area; if COC concentrations are found to exceed STCLs, then further action will be recommended.
Groundwater monitoring. Because the remedy is a source area remedial action, it does not include a groundwater migration management component; however, groundwater monitoring will occur annually for 5 years to support ongoing groundwater investigations, which will be a part of another report.

Five-year review. To provide an opportunity for review of the performance of the selected remedy, AFCEE will perform 5-year site reviews for AOC CS-10/FS-24. During the 5-year review, AFCEE will review monitoring and other pertinent data to assess whether the selected remedy remains protective of human health and the environment and whether additional remedial action is appropriate.

In addition, as part of the remedial design, it will be determined whether additional remedial action is warranted with regard to the Building 4606 drainage structures, including but not limited to removal and proper disposal of all contaminated liquids in the Building 4606 drainage structure, removal of the drainage structures, and investigation to determine the source of the contamination and characterize the nature and extent of any soil contamination associated with the structures, and excavation and/or treatment of any contaminated soils.

Some changes to the selected remedy may be made during the remedial design and construction processes. Such changes in general reflect modifications resulting from the engineering design process.

2.11 STATUTORY DETERMINATIONS

The selected. remedy for AOC CS-10/FS-24 is consistent with CERCLA and, to the extent practicable, the NCP. The selected remedy is protective of human health and the environment, attains ARARs, and is cost-effective. The statutory preference for treatment that permanently and significantly reduces the toxicity, mobility, or volume of hazardous substances as a principal element is satisfied. Additionally, the selected remedy uses alternative treatment technologies to the maximum extent practicable for this site.

2.11.1 The Selected Remedy is Protective of Human Health and the Environment

The selected remedy for AOC CS-10/FS-24 protects human health and the environment by excavating contaminated surface soils and sediments that pose an unacceptable risk to human health or the environment or exceed risk-based or leaching-based STCLs, asphalt-encapsulating those contaminated soils and sediments that are recyclable, and disposing of those contaminated soils and sediments that are not recyclable off-site; treating contaminated subsurface soils by thermally enhanced in situ SVE; and removing and treating surface water at an on-site or off-site wastewater treatment plant. The selected remedy is protective of human health and the environment, attains ARARs, and is cost-effective. The statutory preference for treatment that permanently and significantly reduces the toxicity, mobility, or volume of hazardous substances as a principal element is satisfied. Soils and sediments that are determined to exceed RCRA TCLP allowable concentrations or to contain contaminant concentrations above MADEP MCP Method 1 S-1/GW-1 Standards for pesticides or Massachusetts Permitted Soil Recycling Facility Summary Levels will be disposed off-site in a RCRA Subtitle C TSDF. Soils and sediments that are determined to be below RCRA TCLP allowable concentrations and to contain contaminant concentrations below MADEP MCP Method 1 S-1/GW-1 Standards for pesticides and Massachusetts Permitted Soil Recycling Facility Summary Levels will be treated at the on-site cold-mix emulsion asphalt-batching plant.

Encapsulation of the excavated soils will occur through cold-mix asphalt batching conducted within the MMR facility. The asphalt paving material generated by the batching process would be used immediately for subpaving of roads and parking lots at MMR.

The principal threats at AOC CS-10/FS-24 are human and ecological receptor exposure to surface soil, sediment, and surface water and exposure to contaminated groundwater resulting from potential leaching of VOCs, SVOCs, pesticides, PCBs, inorganics, and TPH compounds into groundwater. Cleanup levels achieved through excavation, treatment, and disposal for human health are based on DSRP STCLs. No unacceptable short-term risks or cross-media impacts will be caused by implementation of the remedy. These cleanup levels will reduce risks from identified exposure pathways to levels within USEPA's target risk range (1×10^{-4} to 1×10^{-6}) for carcinogens and an HI of 1.0 for noncarcinogens. Cleanup levels for ecological receptors are based on DSRP STCLs and will reduce risks from identified exposure pathways to levels that would be below an ecological HI of 1.0, USEPA's threshold for ecological risk.

In addition, this remedial action will support the groundwater operable unit investigation for CS- 10D, which requires that cleanup at source units be sufficient to prevent leaching of COCs to groundwater above levels that threaten human health via groundwater exposure. These levels correspond to a human health carcinogenic risk via ingestion of drinking water of 1×10^{-6}.

2.11.2 The Selected Remedy Will Attain Applicable or Relevant and Appropriate Requirements

The selected remedy will attain all federal and state ARARs. No waivers are required. ARARS for AOC CS-10/CS-24 were identified and discussed in the FFS (HAZWRAP 1998). Tables 2-16 through 2-18, Appendix B, summarize the ARARs applicable to the selected remedy. No chemical-specific ARARs were identified for AOC CS-10/FS-24. However, USEPA CSFs and noncarcinogenic RfDs used in the context of estimating human health risks for the development of STCLs are to-be-considered criteria. RfDs are considered the levels unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure for a lifetime. RfDs are used to calculate risk-based STCLs for noncarcinogens in various media. CSFs represent the most up-to-date information on cancer risk from USEPA's Carcinogen Assessment Group. USEPA CSFs are used to compute the cancer risk-based STCLs for certain chemicals.

The RCRA Standards for Owners and Operators of Hazardous Waste TSDF Facilities (40 CFR Part 264) are applicable to the selected remedy. Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. Source area soils and sediments will be temporarily stockpiled on-site in accordance with these state hazardous waste storage regulations. In addition, the RCRA TCLP regulations (40 CFR 261.24) are applicable. These requirements identify the maximum concentrations of contaminants for which the waste would be a RCRA characteristic waste because of its toxicity. Excavated source area soils and sediments will be analyzed by the TCLP to determine whether they are characteristic hazardous waste under RCRA. Soils and sediments that are determined to exceed RCRA TCLP allowable concentrations or to contain contaminant concentrations above MADEP MCP Method 1 S-1/GW-1 for pesticides or Massachusetts Permitted Soil Recycling Facility Summary Levels will be disposed off-site in a RCRA Subtitle C TSDF. Soils and sediments that are determined to be below RCRA TCLP allowable concentrations and to contain contaminant concentrations below MADEP MCP Method 1 S-1/GW-1 for pesticides and Massachusetts Permitted Soil Recycling Facility Summary Levels will be treated at the on-site cold-mix emulsion asphalt batching plant.

The CWA NPDES regulations (33 USC 1342; 40 CFR Parts 122-125, 131, and 136) are also applicable. The NPDES permit program specifies the permissible concentration or level of contaminants in the discharge from any point source, including the channeling of site runoff, to United States waters. Remedial activities will be controlled to meet NPDES discharge requirements including requirements for surface and storrn water runoff.

The Massachusetts Air Pollution Control Regulations (310 CMR 7.00) are applicable. These regulations set emission limits necessary to attain ambient air quality standards. Remedial activities will be conducted to meet the standards for visible emissions (310 CMR 7.06); dust, odor, construction, and demolition (310 CMR 7.09); noise (310 CMR 7.10); and VOCs (310 CMR 7.18). If these standards are exceeded, emissions will be managed through engineering controls.

The MADEP Interim Remediation Waste Policy for Petroleum Contaminated Soils (WSC-94-400) is to be considered. This policy outlines management practices for reuse, recycling, disposal, storage and transport of petroleum-contaminated soils. Excavated source area soils and sediments will be analyzed to determine whether they contain contaminant concentrations below the Massachusetts Permitted Soil Recycling Facility Summary Levels set out in this policy. Soils and sediments that are determined to contain contaminant concentrations above these Permitted Soil Recycling Facility Summary Levels will be disposed off-site in a licensed TSDF. Soils and sediments that are determined to contain contaminant concentrations at or below these levels (and that are determined to be below RCRA TCLP allowable concentrations and to contain contaminant concentrations below MCP Method 1 S-1/GW-1 Standards for pesticides) will be treated at the onsite cold-mix emulsion asphalt-batching plant.

Location-specific ARARs consist of four applicable regulations.

1. Protection of Wetlands, Executive Order 11990 (40 CFR Part 6, Appendix A) Appendix A of 40 CFR Part 6 sets forth USEPA policy for carrying out the provisions of Executive Order 11990. Federal agencies are required to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. Appendix A requires that no remedial alternatives adversely affect a wetland if another practicable alternative is available. Excavation of contaminated soils and sediments will be performed to minimize adverse impacts on the wetlands in the vicinity of the Eastern Storm Sewer Outfall Drainage Ditch (Detail E). Any portion of these wetlands that is adversely affected will be restored or replaced.

2. The CWA Section 404(b)(i) Guidelines for Specification of Disposal Sites for Dredge or Fill Material (33 USC 1344; 33 CFR Parts 320-323; 40 CFR Part 230) is applicable. CWA Section 404 regulates the discharge of dredged or fill material into United States waters, including wetlands. The purpose of Section 404 is to ensure that proposed discharges are evaluated with respect to impacts on the aquatic ecosystem. The Section 404 regulations maintain that no discharge of dredged or fill material is permitted if practicable alternatives that would have less negative impact on the wetland are available. If there is no practicable alternative, impacts must be mitigated. Excavation of contaminated soils and sediments will be performed to mitigate negative impacts on the wetlands in the vicinity of the Eastern Storm Sewer Outfall Drainage Ditch (Detail E). Any portion of these wetlands that is negatively impacted will be restored or replaced.

3. Massachusetts Wetlands Regulations (310 CMR 10.00). These regulations apply to all activities that will remove, fill, dredge, or alter any inland and coastal wetland area subject to protection under MGL Chapter 131, Section 40, or alter a buffer zone within 100 feet of any such area. Excavation of contaminated soils and sediments will be performed in such a manner that the wetlands in the vicinity of the Eastern Storm Sewer Outfall Drainage Ditch (Detail E) are not adversely impacted.

4. Massachusetts Endangered Wildlife and Wild Plants (321 CMR 8.00). The Commonwealth of Massachusetts has authority to research, list, and protect any species deemed endangered, threatened, or of special concern. These species are listed as either endangered, threatened, or species of special concern in the regulations. The Massachusetts lists may differ from the federal lists of endangered species. Three state-listed species (grasshopper sparrow, upland sandpiper, and northern harrier) are known to inhabit the grassland areas of MMR. Actions will be conducted in a manner that minimizes the effect on Massachusetts-listed endangered species and species listed by the Massachusetts Natural Heritage Program. Endangered or threatened species in the area of AOC CS-10/FS-24 will be identified during the design. Remedial activities will not adversely affect listed species.

2.11.3 The Selected Remedy is Cost-Effective

In AFCEE's judgment, the selected remedy is cost-effective (i.e., the remedy affords overall effectiveness proportional to its costs). In selecting this remedy (and after AFCEE identified alternatives that are protective of human health and the environment and attain, or, as appropriate, waive ARARs), AFCEE evaluated the overall effectiveness of each alternative according to the relevant three criteria: (1) long-term effectiveness and permanence; (2) reduction in toxicity, mobility, or volume through treatment; and (3) short-term effectiveness. The relationship of the overall effectiveness of this remedial alternative was determined to be proportional to its costs.

The costs of this remedial alternative are:

Estimated Capital Cost	$746,659
Estimated O&M Cost (Present Worth)	$550,800
Estimated Total Cost	$1,297,459

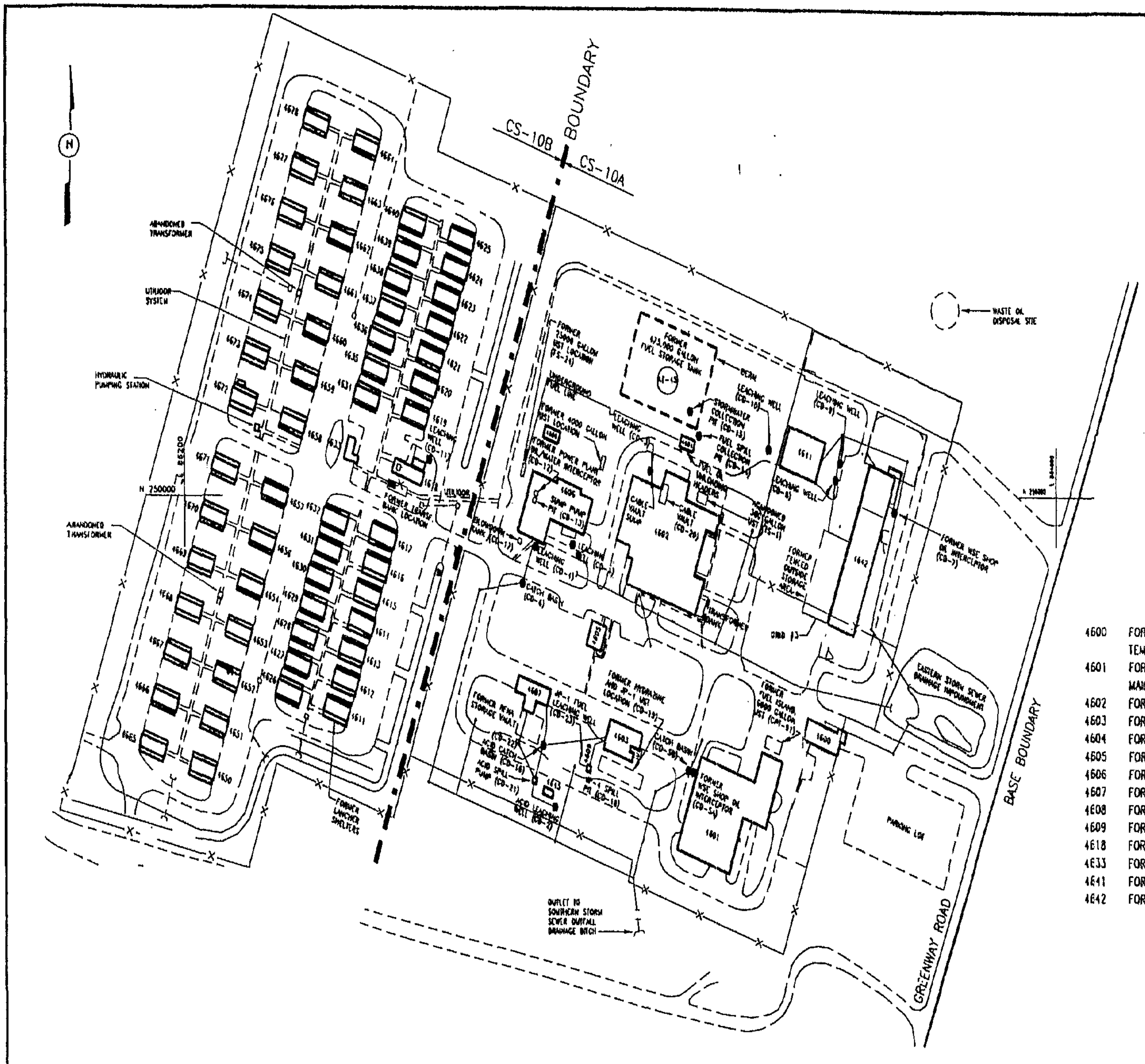
2.11.4 The Selected Remedy Utilizes Permanent Solutions and Alternative Treatment or Resource Recovery Technologies to the Maximum Extent Practicable

AFCEE has determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be used in a cost-effective manner for the final source control operable unit at AOC CS-10/FS-24. Of those alternatives that are protective of human health and the environment and comply with ARARs, AFCEE has determined that this selected remedy provides the best balance of tradeoffs among long-term effectiveness and permanence; reduction in toxicity, mobility, or volume achieved through treatment; short-term effectiveness; implementability; and cost considering the statutory preference for treatment as a principal element and considering state and community acceptance.

The selected remedy provides optimum long-term effectiveness and permanence. Of the evaluated alternatives, Excavation, On-Site Asphalt Batching and On-Site Disposal/In situ Thermally Enhanced SVE/Environmental Monitoring ensures that the maximum amount of soil possible is either treated in place or permanently removed and recycled or disposed of at an approved, regulated Subtitle C TSDF. Relative to the other alternatives, this process provides the most permanent solution with the maximum treatment/resource recovery possible and reduces the human health and ecological risks at the AOC to levels equal to those of the other remedies.

The selected alternative does not offer the highest degree of short-term effectiveness, but only because excavation and treatment, as with any treatment technology, create potential opportunities for added exposures. Measures to control potential releases during excavation, asphalt batching, stockpiling of soils, and in situ SVE will prevent exposure through engineering controls identified and implemented as part of the Health and Safety Plan.

The selected remedy provides a reduction in mobility through encapsulation and treatment. All other alternatives are ineffective. With respect to implementability, the selected alternative is relatively difficult to implement, but it affords a more permanent and treatment oriented solution.



BUILDING KEY

4600	FORMER BOMARC SECURITY/FIRE STATION (CAMP EDWARDS TEMPORARY HAZARDOUS WASTE STORAGE FACILITY)
4601	FORMER BOMARC MAINTENANCE SHOP (CURRENT UTES MAINTENANCE SHOP)
4602	FORMER BOMARC TESTING/MAINTENANCE SHOP
4603	FORMER JP-3/HYDRAZINE HANDLING FACILITY
4604	FORMER FUEL OIL PUMPHOUSE
4605	FORMER QUALITY CONTROL/DECON FACILITY
4606	FORMER POWER/HEATING PLANT
4607	FORMER RFNA HANDLING FACILITY
4608	FORMER COOLING TOWER
4609	FORMER JP-4 SPILL PIT
4618	FORMER LAUNCHER AREA COMPRESSOR BUILDING
4633	FORMER WARHEAD STORAGE BUILDING
4641	FORMER BOMARC MAINTENANCE SHOP
4642	FORMER BOMARC MAINTENANCE SHOP AND WAREHOUSE

CS10MAP2.DWG

CDM FEDERAL PROGRAMS CORPORATION
a subsidiary of Camp Dresser & McKee Inc.

SCALE
1"=200'
100 0 200

AOC CS-10/FS-24 SOURCE RI REPORT

UTES/BOMARC CS-10A & CS-10B
OPERABLE UNITS DETAILS

MASSACHUSETTS MILITARY RESERVATION

Fig. 2-3. BOMARC Site Details

The selected remedy, although not the least expensive alternative, affords an option that meets the regulatory preference for on-site treatment. Therefore the Excavation and On-site Asphalt Batching and Off-site Disposal/In Situ Thermally Enhanced SVE/Environmental remedial alternative is determined to be the most appropriate solution for remediation of the contaminated surface soil and sediment at AOC CS- 10/FS-24.

2.11.5 The Selected Remedy Satisfies the Preference for Treatment That Permanently and Significantly Reduces the Toxicity, Mobility, or Volume of Hazardous Substances as a Principle Element

The principal elements of the selected remedy are excavation and treatment of soil and sediment and the removal and treatment of surface water. These element address the principal threats at the AOC CS-10/FS-24: (1) human and ecological receptor exposure to surface soil, sediment, and surface water and (2) exposure to contaminated groundwater resulting from potential leaching of VOCs, SVOCs, pesticides, PCBs, inorganics, and TPH compounds into groundwater. The selected remedy satisfies the statutory preference for treatment as a principal element by providing treatment that reduces COCs to concentrations at or below cleanup goals.

2.12 DOCUMENTATION OF NO SIGNIFICANT CHANGES FOR AOC CS-10/FS-24

AFCEE presented a Proposed Plan for remedial action at the AOC CS-10/FS-24 source areas at a public information meeting held at the Sandwich Public Library in Sandwich, Massachusetts, on September 10, 1998, and at a Public Hearing held at Sandwich Public Library in Sandwich, Massachusetts, on October 1, 1998. There have been no significant changes made to the Excavation and On-site Asphalt Batching and Off-site Disposal/In Situ Thermally Enhanced SVE/Environmental Monitoring preferred alternative presented in the Proposed Plan. However, in July 1999, during the removal of liquids from drainage structures in Building 4606, additional contamination was found. The source of this contamination has not been identified. Upon further investigation, it will be determined whether additional remedial action is warranted. Such remedial action may include but not be limited to removal of the Building 4606 drainage structures and all contaminated liquids in the structures, an investigation to determine the source of contamination in the structures and characterize any soil contamination associated with the structures, and excavation and/or treatment of any contaminated soils.

2.13 STATE ROLE

The Commonwealth of Massachusetts has reviewed the SI, RI, and FFS reports and the Proposed Plan and concurs with the proposed remedial action decisions. The Commonwealth has also reviewed these documents to determine if the decision complies with applicable or relevant and appropriate laws and regulations of the Commonwealth. A copy of the letter of concurrence from the Commonwealth of Massachusetts is attached as Appendix E of this ROD.

Intentional Blank Page

3. REFERENCES

ABB-ES (ABB Environmental Services, Inc.), 1992. *Interim Remedial Investigation UTES/BOMARC and BOMARC Area Fuel Spill AOC CS-10 and AOC FS-24. Installation Restoration Program, Massachusetts Military Reservation, Cape Cod, MA.*

AEHA (U.S. Army Hygiene Agency), 1986. Personal communication.

AFCEE (Air Force Center for Environmental Excellence), 1996. *Final Draft Community Involvement Plan; Massachusetts Military Reservation, Installation Restoration Program,* December 30, 1996.

AFCEE, 1998. *Proposed Plan To Clean up Source Operable Units at the Chemical Spill No. 10 and Fuel Spill No. 24,* September 1998.

AFCEE, 1999. *Draft CS-10 Swale Area Surface Soil Sampling Letter Report,* December 14, 1998.

ASG (Automated Sciences Group, Inc.), 1994. *Risk Assessment Handbook, Volumes I& II, Comprehensive Plan, Appendix C, Installation Restoration Program,* September 1994.

CDM Federal (CDM Federal Programs Corporation), 1995. *Remedial Investigation UTES/BOMARC and BOMARC Area Fuel Spill, AOC CS-10 Groundwater Operable Unit: CS-10Dand Hydrogeologic Region II Study,* revised draft, Installation Restoration Program, Massachusetts Military Reservation, November 1995.

CDM Federal l996. *UTES/BOMARC and BOMARC Area Fuel Spill, AOC CS-10 Groundwater Operable Unit: CS-10D and Hydrogeologic Region II Study* (CDM Federal 1996)

CDM Federal, 1997. *Remedial Investigation UTES/BOMARC and BOMARC Area Fuel Spill (AOC CS-10 and AOC FS-24) Source Operable Units: CS-10A and CS-10B, Volume I-Text,* December 1997.

E.C. Jordan, Co. (E.C. Jordan Co.), 1986. *US. Air Force Installation Restoration Program, Phase I: Records Search, Air National Guard, Camp Edwards, US. Air Force, and Veterans Administration Facilities at Massachusetts Military Reservation, Task 6,* Portland, Maine, December 11, 1986.

E.C. Jordan, 1987. Personal communication.

E. C. Jordan, 1989. Personal communication.

E. C. Jordan, 1990a. Personal communication.

E. C. Jordan, 1990b. Personal communication.

HAZWRAP (Hazardous Waste Remedial Actions Program), 1996. *Soil Target Cleanup Levels, DSRP, Installation Restoration Program, Massachusetts Military Reservation*, January 1996.

HAZWRAP, 1998. *Massachusetts Military Reservation Focused Feasibility Study AOC CS-10/FS-24 Source Operable Units, final,* September 1998.

HAZWRAP, 1999a. *Technical Memorandum, Asbestos Sampling at AOC CS-10/FS-24 Source Operable Unit, Conducted July 8, 1998, Massachusetts Military Reservation,* March 1999.

HAZWRAP, 1999b. *Technical Memorandum on Explosives Sampling Conducted August 18-19, 1998, at the AOC CS-10/FS-24 Source Operable Unit,* March 1999.

Jacobs Engineering Group, 1995. *Drainage Structure Removal Program Remedial Action Work Plan.*

M&E (Metcalf and Eddy), 1993. *Phase II Drainage Structure Investigation - Priority One- Drainage Structure Survey, Installation Restoration Program, Massachusetts Military Reservation, Cape Cod, MA.*

MCP *(Massachusetts Contingency Plan),* 1994. *Massachusetts Code of Regulations* 1994. Subpart I. 310 CMR 40.090000 (MCP).

MMR *(Massachusetts Military Reservation),* 1994. *Plume Response Plan (PRP),* June 1994.

ORNL (Oak Ridge National Laboratory), 1998. *Preliminary Data Analysis for a Qualitative Radiological Survey of the CS-10 B0MARC Facility at the Otis Air National Guard Base, Massachusetts Military Reservation, Falmouth, Massachusetts,* November 13, 1998.

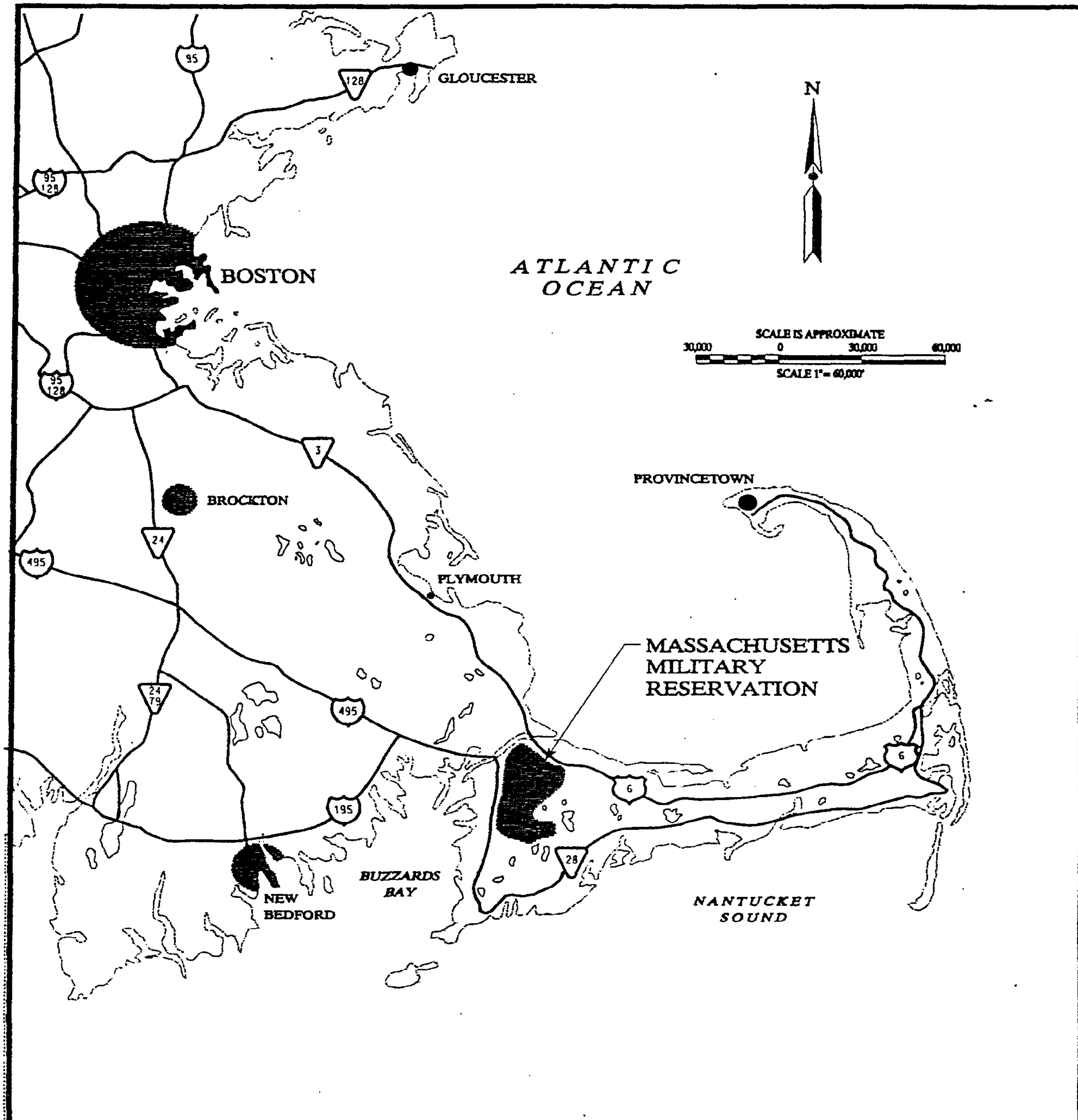
ORNL, 1999. *Final Analysis Report of a Qualitative Radiological Survey of the CS-10 BOMARC Facility at the Otis Air National Guard Base, Massachusetts Military Reservation, Falmouth, Massachusetts.* Oak Ridge National Laboratory, Oak Ridge, Tennessee.

USEPA (U.S. Environmental Protection Agency), 1990. *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions,* U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C., OSWER Directive 9355.0-30.

U.S. Fish and Wildlife Service, 1997. Personal communication.

APPENDIX A— FIGURES

Intentional Blank Page



LEGEND

HAZWRAP
HAZARDOUS WASTE REMEDIAL ACTIONS PROGRAM
DEPARTMENT OF ENERGY MANAGED BY LOCKHEED MARTIN ENERGY SYSTEMS, INC.

SCALE: APPROXIMATE
DATE: 11-18-98
FILENAME: MMRH610.DGN

Fig. 2-1. Location of the Massachusetts Military Reservation

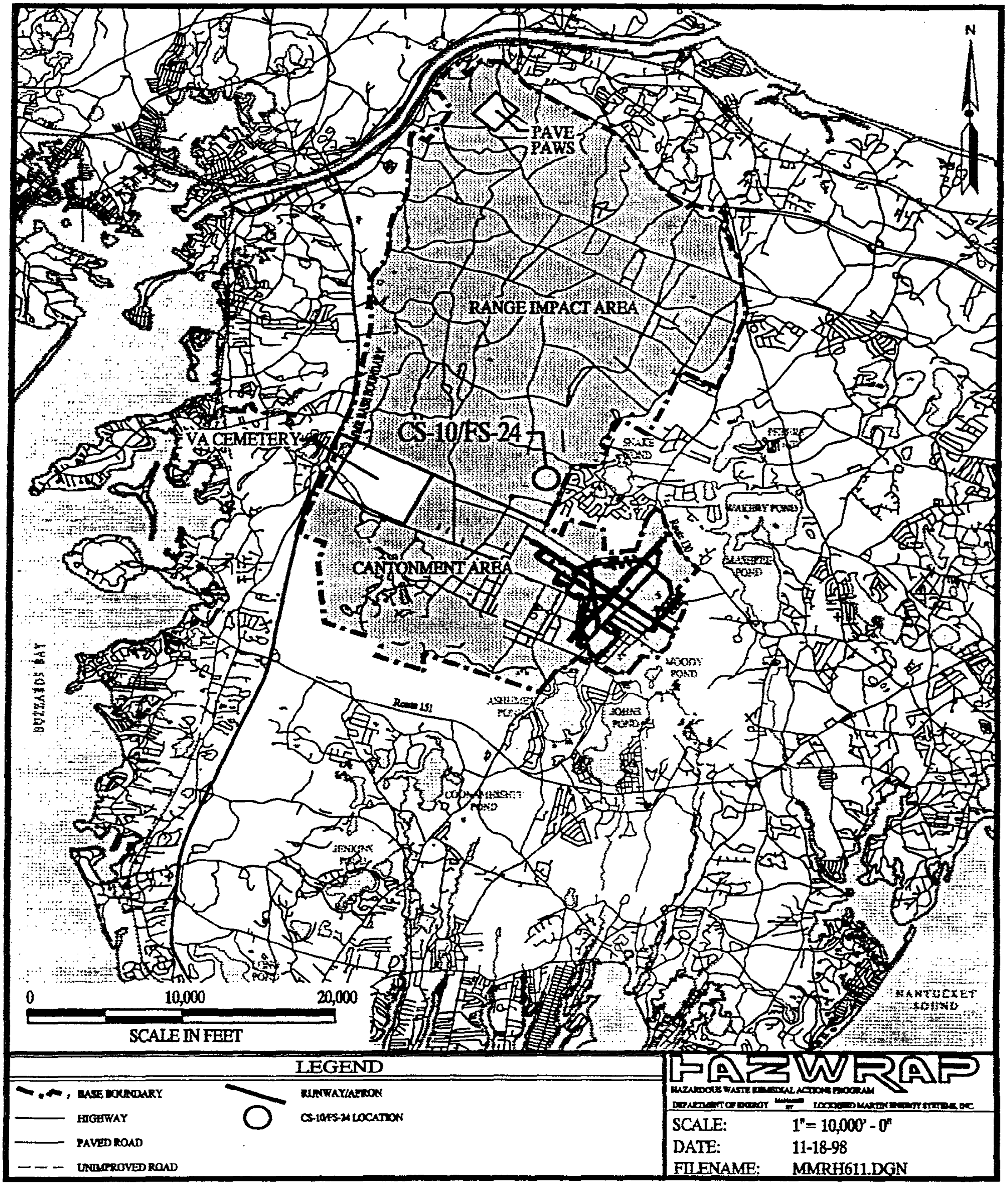


Fig. 2-2. Location of AOC CS-10/FS-24 at MMR

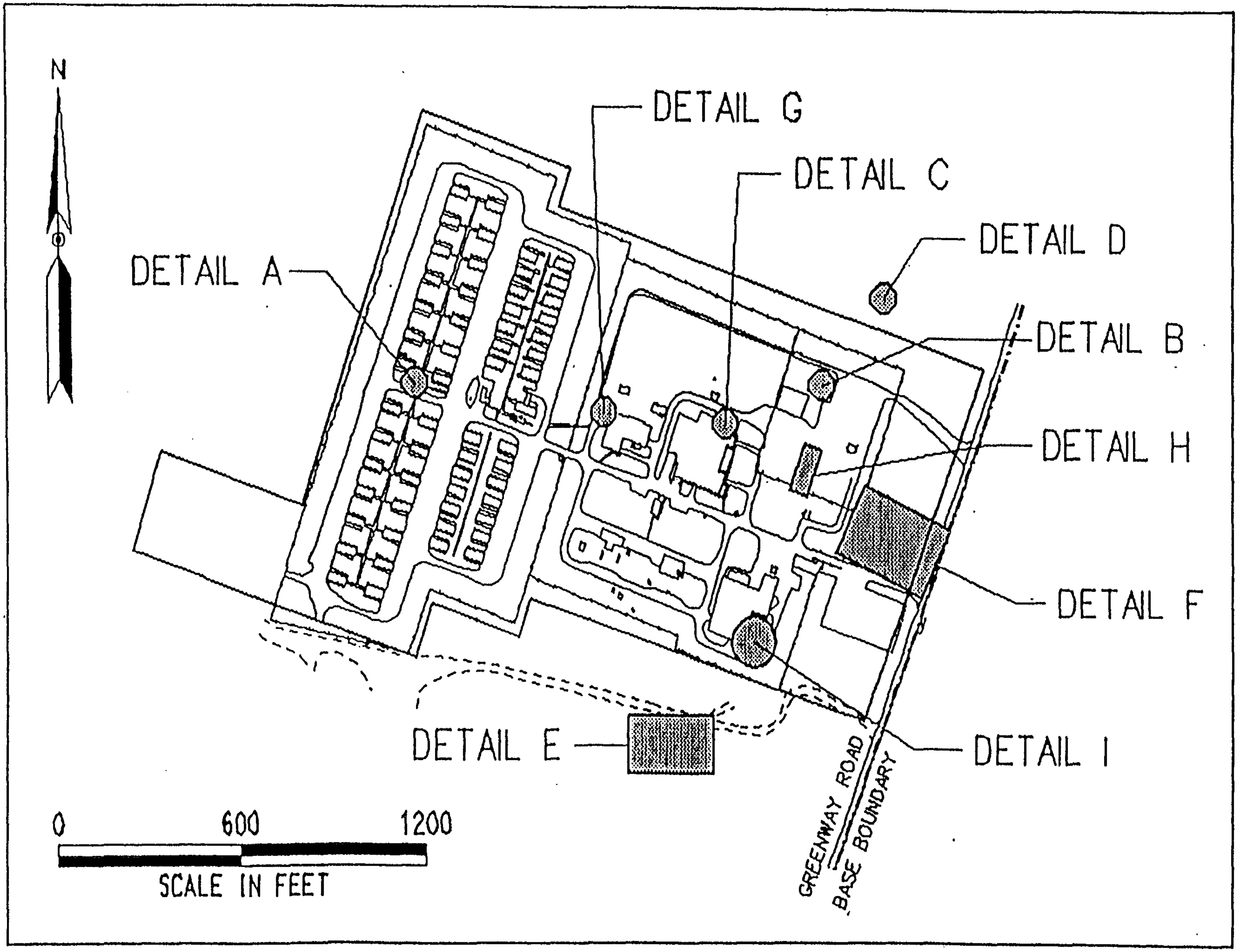


Figure 2-4. AOC CS-10/FS-24 Source Areas

APPENDIX B— TABLES

TABLE 2-4
COMPARISON OF CONTAMINANTS TO SOIL TARGET CLEANUP LEVELS
DETAIL C: SOILS AT UST TS-1 AT BUILDING 4602

SAMPLE NO./ CONTAMINANT	MAXIMUM CONCENTRATION IN SOIL (μg/kg)	STCL or MCP S-1/GW-1 (μg/kg)	BASIS FOR STCL
MS-123: 5, 10, 95 feet TP-19: 3 feet			
VOCs			
PCE	920	10	LEACH
TPH	3,700,000	500,000	MCP

-- denotes that the contaminant does not exceed the STCL.
Basis for STCL Exceedance
HRISK- Human health risk
ERISK- Ecological risk
LEACH- Potential for leaching to groundwater
BKGD- MMR background for inorganics
MCP- Potential for leaching to groundwater or risk-based criteria

TABLE 2-5
COMPARISON OF CONTAMINANTS TO SOIL TARGET CLEANUP LEVELS
DETAIL D: WASTE OIL DISPOSAL SITE

SAMPLE NO./ CONTAMINANT	MAXIMUM CONCENTRATION IN SOIL (μg/kg)	STCL or MCP S-1/GW-1 (μg/kg)	BASIS FOR STCL
SS-6, SS-7, SS-8: 0 feet			
VOCs			
Methylene chloride	11J	10	LEACH
TPH	68,000,000	500,000	MCP
INORGANICS			
Lead	34,600	15,800	ERISK
ZINC	81,700	16,000	BKGB

-- denotes that the contaminant does not exceed the STCL.
Basis for STCL Exceedance
HRISK- Human health risk
ERISK- Ecological risk
LEACH- Potential for leaching to groundwater
BKGD- MMR background for inorganics
MCP- Potential for leaching to groundwater or risk-based criteria

TABLE 2-6
COMPARISON OF CONTAMINANTS TO SOIL TARGET CLEANUP LEVELS
DETAIL E: SOUTHERN STORM SEWER OUTFALL DRAINAGE DITCH

SAMPLE NO./ CONTAMINANT	MAXIMUM CONCENTRATION IN SOIL/ SEDIMENT (µg/kg)	STCL or MCP S-1/GW-1 (µg/kg)	BASIS FOR STCL
SD-1, SD-2, SD-5, SD-6, SD-7, SS-15, SS-16: 0 feet TP-17: 2 feet			
VOCs			
Benzene	810J	10	LEACH
SVOCs			
Phenanthrene	21,000	625	ERISK
Fluoranthene	28,000	7,810	ERISK
Pyrene	20,000	4,690	ERISK
Benzo(a)anthracene	11,000	5,000 total cPAHs	ERISK
Chrysene	13,000	625	ERISK
Benzo(b)fluoranthene	11,000	5,000 total cPAHs	ERISK
Benzo(k)fluorenthene	8,300	5,000 total cPAHs	ERISK
Benzo(a)pyrene	8,900	5,000 total cPAHs	ERISK
Indeno(1,2,3-cd)pyrene	960	5,000 total cPAHs	ERISK
Dibenz(a,h)anthracene	450J	5,000 total cPAHs	ERISK
Benzo(g,h,I)perylene	910	5,000 total cPAHs	ERISK
PETSICIDES			
Endosulfan II	330F	200	MCP
Dieldrin	670	35	ERISK
PCBs			
Aroclor-1260	930	158	HRISK
Aroclor-1254	550J	158	HRISK
TPH	2,710,000	500,000	MCP
INORGANICS			
Arsenic	5,100	3,600	BKGD
Chromium	123,000	6,800	BKGD
Copper	383,000	19,300	ERISK
Lead	478,000	15,800	ERISK
Manganese	461,000	274,000	HRISK

SAMPLE NO./ CONTAMINANT	MAXIMUM CONCENTRATION IN SOIL/ SEDIMENT (μg/kg)	STCL or MCP S-1/GW-1 (μg/kg)	BASIS FOR STCL
Vanadium	68,300	15,200	BKGD
Zinc	213,000	16,000	BKGD
Cyanide	1,200J	1,000	BKGD

-- denotes that the contaminant does not exceed the STCL.

Basis for STCL Exceedance

cPAH carcinogenic PAHs
HRISK- Human health risk
ERISK- Ecological risk
LEACH- Potential for leaching to groundwater
BKGD- MMR background for inorganics
MCP- Potential for leaching to groundwater or risk-based criteria

TABLE 2-7
COMPARISON OF CONTAMINANTS IN SOIL TO SOIL TARGET CLEANUP LEVELS
DETAIL F: EASTERN STORM SEWER DRAINAGE IMPOUNDMENT

SAMPLE NO./ CONTAMINANT	MAXIMUM CONCENTRATION IN SOIL (μg/kg)	STCL or MCP S-1/GW-1 (μg/kg)	BASIS FOR STCL
SS-017, SS-018: 0 feet TP-13, TP-14: 2 feet			
VOCS			
Methylene chloride	191	10	LEACH
SVOCs			
2-Methylnaphthalene	860	700	MCP
Phenanthrene	29,000	625	ERISK
Carbazole	3,200	3,120	ERISK
Fluoranthene	20,000	7,810	ERISK
Pyrene	18,000	4,690	ERISK
Benzo(a)anthracene	11,000	5,000 total cPAHs	ERISK
Chrysene	11,000	625	ERISK
Benzo(b)fluoranthene	16,000J	5,000 total cPAHs	ERISK
Benzo(k)fluoranthene	16,000J	5,000 total cPAHs	ERISK
Benzo(a)pyrene	6,000J	5,000 total cPAHs	ERISK
Indeno(1,2,3-cd)pyrene	2,600J	5,000 total cPAHs	ERISK
Dibenz(a,h)anthracene	1,800J	5,000 total cPAHs	ERISK
Benzo(g,h,i)perylene	2,600J	5,000 total cPAHs	ERISK
PESTICIDES			
Dieldrin	92	35	ERISK
PCBs			
Aroclor-1254	540	158	HRISK
TPH	20,200,000	500,000	MCP
INORGANICS			
Chromium	21,400	6,800	BKQD
Copper	47,300J	19,300	ERISK
Lead	69,700	15,800	ERISK

SAMPLE NO./ CONTAMINANT	MAXIMUM CONCENTRATION IN SOIL (μg/kg)	STCL or MCP S-1/GW-1 (μg/kg)	BASIS FOR STCL
Vanadium	28,700	15,200	BKGD
Zinc	76,100	16,000	BKGD
TP-15: 4 feet (S. outfall)			
TPH	1,470,000	500,000	MCP
INORGANICS			
Manganese	465,000	274,000	hrisk

-- denotes that the contaminant does not exceed the STCL.

Basis for STCL Exceedance

HRISK - Human health risk
ERISK - Ecological risk
LEACH - Potential for leaching to groundwater
BKGD - MMR background for inorganics
MCP- Potential for leaching to groundwater or risk-based criteria

Table 2-13 Summary of COCs, East Pond Area Source Area

COMPOUND	MEDIA	MINIMUM (mg/kg) (mg/kg) (ug/L)	MAXIMUM (mg/kg) (mg/kg) (ug/L)	AVERAGE (CDM data only) (mg/kg) (mg/kg) (ug/L)	DETECTS (CDM data only)	SAMPLE (CDM data only)	BACKGROUND (mg/kg) (mg/kg) (ug/L) MIN	BACKGROUND Max	MMR, RISK CONCENTRATION SOIL, (mg/kg) WATER (ug/L) 1E-8 (cancer)	HQ=0.2 (non-cancer	COC
VOCs											
Acetone	soil	ND	ND	ND	0	2			--	5.49E+3	
	sed	ND	ND	ND	0	2			--	7.30E+5	
	sw	ND	ND	ND	0	2			--	3.20E+4	
Methylene Chloride	soil	ND	ND	ND	0	2			8.54E+1	9.32E+2	
	sed	ND	0.043	ND	0	2			1.14E+4	4.36E+5	
	sw	ND	ND	ND	0	2			1.77E+2	1.43E+3	
Toluene	soil	ND	ND	ND	0	2			--	5.93E+2	
	sed	ND	ND	ND	0	2			--	1.46E+6	
	sw	ND	ND	ND	0	2			--	3.69E+2	
Trichloroethene	soil	ND	ND	ND	0	2			5.49E+0	3.84E+2	
	sed	ND	ND	ND	0	2			7.74E+3	5.11E+4	
	sw	ND	ND	ND	0	2			2.35E+1	4.86E+1	
SVOCs											
Acenaphthene	soil	1.4	3.1	2.25	2	2			--	3.29E+3	
	sed	0.044	0.044	0.044	1	2			--	4.38E+5	
	sw	ND	ND	ND	0	2			--	2.55E+1	
Acenaphthylene	soil	0.077	0.077	0.077	1	2			--	2.20E+3	
	sed	0.061	0.098	0.0795	2	2			--	2.92E+5	
	sw	ND	ND	ND	0	2			--	2.16E+1	
Anthracene	soil	1.9	3.3	2.6	2	2			--	1.65E+4	
	sed	ND	ND	ND	0	2			--	2.19E+6	
	sw	ND	ND	ND	0	2			--	5.63E+0	
Benzo(a)anthracene	soil	4.5	11	7.75	2	2			8.77E-1	--	YES
	sed	0.3	0.4	0.35	2	2			1.17E+2	--	ECO4
	sw	ND	ND	ND	0	2			2.52E-1	--	
Benzo(b)fluoranthene	soil	6.4	16.0	11.2	2	2			8.77E-1	--	YES
	sed	0.61	0.97	0.79	2	2			1.17E+2	--	
	sw	ND	ND	Nd	0	2			2.51E-1	--	
Benzo(k)fluoranthene	soil	6.4	16.0	11.2	2	2			8.75E+0	--	YES
	sed	0.61	0.97	0.79	2	2			1.17E+3	--	
	sw	ND	Nd	Nd	0	2			2.51E+0	--	
Benzo(a)pyrene	soil	3.6	6.0	4.8	2	2			8.77E-2	--	YES
	sed	0.25	0.42	0.335	2	2			1.17E+1	--	ECO4
	sw	ND	Nd	ND	0	2			2.51E-2	--	
Benzo(g,h,i)perylene	soil	2.1	2.6	2.35	2	2			--	2.20E+3	EC02
	sed	0.13	0.32	0.225	2	2			--	2.92E+5	
	sw	ND	ND	ND	0	2			--	1.25E-1	
Bis(2-ethylhexyl)phthalate	soil	ND	ND	ND	0	2			4.57E+1	1.10E+3	
	sed	ND	ND	ND	0	2			6.08E+3	1.46E+5	
	sw	1	1	1	2	2			1.33E+1	3.20E-2	YES
Butylbenzylphthalate	soil	ND	ND	ND	0	2			--	1.10E+4	
	sed	ND	0.71	ND	0	2			--	1.46E+6	
	sw	ND	ND	ND	0	2			--	5.14E+1	
Carbazole	soil	1.3	3.2	2.25	2	2			3.20E+1	--	ECO2
	sed	0.48	0.77	0.063	2	2			4.28E+3	--	
	sw	ND	ND	ND	0	2			3.28E+3	--	
Chrysene	soil	4.3	11.0	7.65	2	2			8.77E+1	--	ECO2
	sed	0.34	0.55	0.445	2	2			1.17E+4	--	
	sw	ND	ND	ND	0	2			2.52E+1	--	
Dibenzo(a,h)anthrancene	soil	1.4	1.8	1.6	2	2			8.77E-2	--	YES
	sed	ND	ND	ND	0	2			1.17E+1	--	
	sw	ND	ND	ND	0	2			2.50E-2	--	
Debenzofuran	soil	1.1	2.4	1.75	2	2			--	2.20E+2	
	sed	ND	ND	ND	0	2			--	2.92E+4	
	sw	ND	ND	ND	0	2			--	9.53E-1	
1,4-Dichlorobenzene	soil	ND	ND	ND	0	2			2.67E+1	4.71E+3	
	sed	ND	ND	ND	0	2			3.55E+3	--	
	sw	ND	ND	ND	0	2			5.11E+0	--	
Di-n-butylphthalate	soil	ND	ND	ND	0	2			--	5.49E+3	
	sed	ND	ND	ND	0	2			--	7.30E+5	
	sw	ND	ND	ND	0	2			--	2.58E+0	
Di-n-octylphthalate	soil	ND	ND	ND	0	2			--	1.10E+3	
	sed	ND	ND	ND	0	2			--	1.46E+5	
	sw	ND	ND	ND	0	2			--	7.44E-3	
Fluoranthene	soil	9.3	20.0	14.65	2	2			--	2.20E+3	ECO2
	sed	0.6	0.9	0.75	2	2			--	2.92E+5	ECO4
	sw	ND	ND	ND	0	2			--	2.33E+0	

Table 2-13 Summary of COCs, East Pond Area Source Area

COMPOUND	MEDIA	MINIMUM (mg/kg) (mg/kg) (ug/L)	MAXIMUM (mg/kg) (mg/kg) (ug/L)	AVERAGE (CDM data only) (mg/kg) (mg/kg) (ug/L)	DETECTS (CDM data only)	SAMPLE (CDM data only)	BACKGROUND MIN (mg/kg) (mg/kg) (ug/L)	BACKGROUND Max	MMR, RISK CONCENTRATION SOIL, (mg/kg) WATER (ug/L) 1E-8 (cancer)	HQ=0.2 (non-cancer	COC
Fluorene	soil	1.9	4.5	3.2	2	2			--	2.20E+3	
	sed	0.044	0.082	0.063	2	2			--	2.92E+5	ECO4
	sw	ND	ND	ND	0	2			--	3.80E+0	
Indeno(1,2,3-cd)pyrene	soil	2.2	2.6	2.4	2	2			8.77E-1	--	YES
	sed	0.14	0.24	0.19	2	2			1.17E+2	--	
	sw	ND	ND	ND	0	2			2.50E-1	--	
2-methylnaphthalene	soil	0.53	0.86	0.695	2	2			--	--	HUM
	sed	ND	ND	ND	0	2			--	--	
	sw	ND	ND	ND	0	2			--	--	
Naphthalene	soil	0.32	1.6	0.96	2	2			--	2.20E+3	ECO2
	sed	ND	ND	ND	0	2			--	2.92E+5	
	sw	ND	ND	ND	0	2			--	2.11E+1	
4-Nitrophenol	soil	ND	ND	ND	0				--	--	
	sed	ND	ND	ND	0				--	--	
	sw	ND	ND	ND	0				--	--	
Pentachlorophenol	soil	ND	ND	ND	0	2			5.34E+0	1.65E+3	
	sed	ND	ND	ND	0	2			7.10E+2	2.19E+5	
	sw	ND	ND	ND	0	2			1.53E+0	1.33E-1	
Phenanthrene	soil	12	29.0	20.5	2	2			--	2.20E+3	ECO2
	sed	0.42	0.63	0.525	2	2			--	2.92E+5	ECO4
	sw	ND	ND	ND	0	2			--	1.35E+0	
Pyrene	soil	6.4	18.0	12.2	2	2			--	1.65E+3	YES
	sed	0.53	0.74	0.635	2	2			--	2.19E+5	ECO4
	sw	ND	ND	ND	0	2			--	3.71E-2	
PEST/PCBs											
Aldrin	soil	ND	ND	ND	0	2			1.26E-1	5.49E+0	
	sed	ND	ND	ND	0	2			1.67E+1	7.30E+2	
	sw	ND	ND	ND	0	2			1.78E-2	7.60E-5	
Aroclor-1248	soil	ND	ND	ND	0	2			1.58E-1	--	
	sed	ND	ND	ND	0	2			3.07E+0	--	
	sw	ND	ND	ND	0	2			2.39E-2	--	
Aroclor-1254	soil	0.16	0.49	0.325	2	2			1.58E-1	--	HUM
	sed	0.63	0.18	0.1215	2	2			3.07E+0	--	ECO4
	sw	ND	ND	ND	0	2			2.39E-2	--	
Aroclor-1260	soil	ND	ND	ND	0	2			1.58E-1	--	
	sed	ND	ND	ND	0	2			3.07E+0	--	
	sw	ND	ND	ND	0	2			2.39E-2	--	
4,4-DDE	soil	ND	ND	ND	0	2			6.28E+0	1.28E+2	
	sed	ND	ND	ND	0	2			8.35E+2	1.70E+4	
	sw	ND	ND	ND	0	2			5.40E-1	6.73E-6	
4,4-DDT	soil	ND	ND	ND	0	2			6.28E+0	9.15E+1	
	sed	ND	ND	ND	0	2			8.35E+2	1.22E+4	
	sw	ND	ND	ND	0	2			5.38E-1	1.95E-5	
Dieldrin	soil	0.031	0.086	0.0585	2	2			1.33E-1	9.15E+0	ECO2
	sed	0.19	0.26	0.225	2	2			1.77E+1	1.22E+4	ECO4
	sw	ND	ND	ND	0	2			1.19E-2	1.27E-4	
Endosulfan I	soil	ND	ND	ND	0	2			--	1.10E+3	
	sed	ND	ND	ND	0	2			--	1.46E+5	
	sw	ND	ND	ND	0	2			--	3.43E+0	
Endosulfan II	soil	ND	ND	ND	0	2			--	1.10E+3	
	sed	ND	ND	ND	0	2			--	1.46E+5	
	sw	ND	ND	ND	0	2			--	3.43E+0	
Endosulfan Sulfate	soil	ND	ND	ND	0	2			NL	NL	YES
	sed	ND	0.19	ND	0	2			NL	NL	
	sw	ND	ND	ND	0	2			NL	NL	
Endrin	soil	ND	ND	ND	0	2			--	5.49E+1	
	sed	ND	ND	ND	0	2			--	7.30E+3	
	sw	ND	ND	ND	0	2			--	3.46E-3	
Endrin Ketone	soil	ND	ND	ND	0	2			--	--	
	sed	ND	ND	ND	0	2			--	--	
	sw	ND	ND	ND	0	2			--	--	
Heptachlor Epoxide	soil	ND	ND	ND	0	2			2.35E-1	2.38E+0	
	sed	ND	ND	ND	0	2			3.12E+1	3.16E+2	
	sw	ND	ND	ND	0	2			2.03E-2	1.61E-4	
Methoxychlor	soil	ND	ND	ND	0	2			--	9.15E+2	
	sed	ND	ND	ND	0	2			--	1.22E+5	
	sw	ND	ND	ND	0	2			--	1.22E-2	

Table 2-13 Summary of COCs, East Pond Area Source Area

COMPOUND	MEDIA	MINIMUM (mg/kg) (mg/kg) (ug/L)	MAXIMUM1 (mg/kg) (mg/kg) (ug/L)	AVERAGE (CDM data only) (mg/kg) (mg/kg) (ug/L)	DETECTS (CDM data only)	SAMPLES (CDM data only)	BACKGROUND (mg/kg) (mg/kg) (ug/L) MIN	MAX	MMR, RISK CONCENTRATION SOIL (mg/kg) WATER (ug/L) 1E-6 (cancer)	HQ=0.2 (non-cancer)	coc
INORGANICS											
Aluminum	soil	2700	5320	4010	2	2	1145	8930	–	5.49E+4	
	sed	12500	18500	15500	2	2			–	7.30E+6	EC02
	sw	89.5	551	95.9	2	2			–	1.72E+4	EC01
Antimony	soil	ND	ND	ND	0	2	2.5	17.5	–	2.20E+1	
	sed	ND	ND	ND	0	2			–	2.92E+3	
	sw	ND	ND	ND	0	2			–	7.43E+1	
Arsenic	soil	1.3	2.4	1.85	2	2	0.15	3.0	3.66E-1	1.65E+1	YES
	sed	1.6	2.2	1.9	2	2			4.87E+1	2.19E+3	
	sw	ND	ND	ND	0	2			3.74E+1	1.85E+1	
Barium	soil	11.2	12.3	11.75	2	2	2.0	10.4	–	3.80E+3	
	sed	37.8	51.7	44.75	2	2			–	5.11E+5	
	sw	6.4	7.1	6.73	2	2			–	3.00E+3	
Beryllium	soil	0.27	0.27	0.27	1	2	0.1	0.85	1.49E-1	2.74E+2	HUM
	sed	0.49	0.71	0.6	2	2			1.98E+1	3.65E+4	
	sw	ND	ND	ND	0	2			1.52E+1	4.55E+1	
Cadmium	soil	1.2	1.4	1.3	2	2	0.4	1.5	–	2.64E+1	EC02
	sed	6.6	7.5	7.05	2	2			–	3.65E+3	EC03
	sw	1.8	2.1	1.97	2	2			–	1.16E+2	YES
Chromium	soil	8.2	17.9	13.05	2	2	0.8	6.8	6.57E+2	2.74E+2	EC02
	sed	28.2	38.2	33.2	2	2			–	3.65E+4	EC03
	sw	ND	ND	ND	0	2			–	4.32E+0	
Cobalt	soil	1.8	1.9	1.85	2	2	0.5	4.1	–	–	HUM
	sed	5.8	7	6.4	2	2			–	–	HUM
	sw	ND	ND	ND	0	2			–	–	
Copper	soil	3.2	47.3	39.65	2	2	0.5	5.2	–	–	YES
	sed	37.5	47.1	42.3	2	2			–	–	YES
	sw	5.7	8.1	6.77	2	2			–	–	YES
Lead	soil	38.9	69.7	54.3	2	2	1.3	12.1	–	3.00E+2	YES
	sed	76.1	77.9	77	2	2			–	–	YES
	sw	1.3	16.8	2.07	2	2			–	–	EC01
Manganese	soil	88.1	119	103.6	2	2	16	106	–	2.74E+2	
	sed	118	151	134.5	2	2			–	3.65E+4	EC02
	sw	14	288	14.13	2	2			–	2.47E-3	YES
Mercury	soil	ND	ND	ND	0	2	0.04	0.06	–	1.65E+1	
	sed	ND	ND	ND	0	2			–	2.19E+3	
	sw	ND	ND	ND	0	2			–	6.06E-4	
Nickel	soil	5.1	5.1	5.1	2	2	1.05	5.2	3.21E+4	1.10E+3	
	sed	15.6	22.3	18.95	2	2			–	1.46E+5	EC03
	sw	ND	ND	ND	0	2			–	3.26E+1	
Selenium	soil	ND	ND	ND	0	2	0.08	0.33	–	2.74E+2	
	sed	ND	ND	ND	0	2			–	3.65E+4	
	sw	ND	ND	ND	0	2			–	1.52E-1	
Silver	soil	ND	ND	ND	0	2	0.33	1.4	–	2.74E+2	
	sed	ND	ND	ND	0	2			–	3.65E+4	
	sw	ND	ND	ND	0	2			–	3.09E+1	
Vanadium	soil	18.7	28.7	23.7	2	2	1.13	15.2	–	3.84E+2	EC02
	sed	36.9	51.7	44.3	2	2			–	5.11E+4	EC02
	sw	3.1	3.4	3.25	1	2			–	1.21E+2	
Zinc	soil	68.8	76.1	72.45	2	2	3.1	16	–	1.65E+4	EC02
	sed	205	243	224	2	2			–	2.19E+6	EC03
	sw	56.7	1560	58.23	2	2			–	5.38E+1	YES
Cyanide	soil	ND	ND	ND	0	2	0.19	0.07	–	1.10E+3	
	sed	ND	ND	ND	0	2			–	1.46E+5	
	sw	ND	ND	ND	0	2			–	3.66E+2	

I - Maximum values are derived from CDM Federal sampling results, sampling results presented in the the Interim Remedial Investigation Report (ABB Environmental Services. Inc.; April 1992). and sampling results presented In the Phase II Drainage Structure Investigation (Metcalf & Eddy. Inc.; May 1993).

2 - Values obtained from "Risk Assessment Handbook. Automated Sciences Group. Inc.; September 1994; Appendix F

-- HEC values are not presented for the indicated parameters.

ND Not Detected

NL - Compound is not listed in Risk Assessment Handbook HSC Tables (Appendix F).

YES - Compound is considered both under human health and ecological risk evaluation.

HUM - Compound Is considered under Human Health Risk Evaluation only.

EC01 - Compound concentration exceeds USEPA Ambient Water Criteria.

EC02 - Compound concentration exceeds MMR Hazard Equivalent Concentration.

EC03 - Compound concentration exceeds Ontario Ministry of the Environment Sediment Quality Guidelines.

EC04 - Compound concentration exceeds NOAAERL value,

Table 2-14 Summary of COCs, Southern Drainage Ditch Source Area

COMPOUND	MINIMUM (mg/kg)	MAXIMUM[1] (mg/kg)	AVERAGE (CDM data only)	DETECTS (CDM data only)	SAMPLES (CDM data only)	BACKGROUND MIN (mg/kg)	BACKGROUND MAX	MMR RISK CONCENTRATION[2] SOIL (mg/kg) 1E-6 (cancer)	MMR RISK CONCENTRATION[2] SOIL (mg/kg) HQ=0.2 (non-cancer)	COC
VOCs										
Acetone	ND	ND	ND	0	5			--	7.30E+5	
Methylene Chloride	ND	ND	ND	0	5			1.14E+4	4.83E+5	
Toluene	1	1	1	1	5			--	1.46E+6	
Trichloroethene	ND	ND	ND	0	5			7.74E+3	5.11E+4	
SVOCs										
Acenaphthene	0.16	0.21	0.18	2	2			--	4.38E+5	
Acenaphthylene	0.055	0.064	0.058	2	2			--	2.92E+5	
Anthracene	0.23	0.27	0.243	2	2			--	2.19E+6	EC04
Benzo(a)anthracene	1.4	1.5	1.47	2	2			1.17E+2	–	EC04
Benzo(b)fluoranthene	3.7	4.2	3.7	2	2			1.17E+2	–	EC02
Benzo(k)fluoranthene	3.7	4.2	3.7	2	2			1.17E+3	–	EC02
Benzo(a)pyrene	1.3	8.9	1.3	2	2			1.17E+1	–	YES
Benzo(g,h,i)perylene	0.67	0.8	0.687	2	2			--	2.92E+5	
Bis(2-ethylhexyl)phthalate	0.62	0.62	0.62	2	2			6.08E+3	1.46E+5	
Butylbenzylphthalate	ND	ND	ND	0	2			--	1.46E+6	
Carbazole	0.58	0.6	0.59	2	2			4.26E+3	–	
Chrysene	1.8	2	1.77	2	2			1.17E+4	–	EC04
Dibenzo(a,h)anthracene	0.31	0.45	0.36	2	2			1.17E+1	–	EC04
Dibenzofuran	0.12	0.16	0.137	2	2			--	2.92E+4	
1,4-Dichlorobezene	ND	ND	ND	0	2			3.55E+3	–	
Di-n-butylphthalate	ND	ND	ND	0	2			--	7.30E+5	
Di-n-octylphthalate	ND	ND	ND	0	2			--	1.46E+5	

Table 2-14 Summary of COCs, Southern Drainage Ditch Source Area

COMPOUND	MINIMUM (mg/kg)	MAXIMUM[1] (mg/kg)	AVERAGE (CDM data only)	DETECTS (CDM data only)	SAMPLES (CDM data only)	BACKGROUND		MMR RISK CONCENTRATION[2] SOIL (mg/kg)		COC
						MIN (mg/kg)	MAX	1E-6 (cancer)	HQ=0.2 (non-cancer)	
Fluoranthene	3.6	28	3.83	2	2			--	2.92E+5	EC04
Fluorene	0.2	0.24	0.213	2	2			--	2.92E+5	EC04
Indeno(1,2,3-cd)pyrene	0.88	0.96	0.90	2	2			1.17E+2	–	
2-Methylnaphthalene	0.066	0.071	0.069	2	2			--	–	YES
Naphthalene	0.047	0.047	0.046	2	2			--	2.92E+5	
4-Nitrophenol	ND	ND	ND	2	2			--	–	
Pentachlorophenol	0.063	0.1	0.0815	2	2			7.10E+2	2.19E+5	
Phenanthrene	2.7	3.5	3.0	2	2			--	2.92E+5	ECO4
Pyrene	2.9	20	2.93	2	2			--	2.19E+5	ECO4
PEST/PCBs										
Aldrin	ND	ND	ND	0	1			1.67E+1	7.30E+2	
Aroclor-1248	ND	ND	ND	0	1			3.07E+0	–	
Aroclor-1254	0.55	0.55	0.55	2	2			3.07E+0	–	EC04
Aroclor-1260	0.71	0.77	0.687	2	2			3.07E+0	–	EC03
4,4-DDE	ND	ND	ND	0	1			8.35E+2	1.70E+4	
4,4-DDT	ND	ND	ND	0	1			8.35E+2	1.22E+4	
Dieldrin	0.42	0.48	0.437	2	2			1.77E+1	1.22E+4	EC04
Endosulfan	ND	0.21	ND	0	1			--	1.46E+5	
Endosulfan II	ND	ND	ND	0	1			--	1.46E+5	
Endosulfan Sulfate	ND	ND	ND	0	1			NL	NL	
Endrin	ND	ND	ND	0	1			--	7.30E+3	
Endrin Ketone	ND	ND	ND	0	1			--	–	

Table 2-14 Summary of COCs, Southern Drainage Ditch Source Area

COMPOUND	MINIMUM (mg/kg)	MAXIMUM[1] (mg/kg)	AVERAGE (CDM data only)	DETECTS (CDM data only)	SAMPLES (CDM data only)	BACKGROUND		MMR RISK CONCENTRATION[2] SOIL (mg/kg)		COC
						MIN (mg/kg)	MAX	1E-6 (cancer)	HQ=0.2 (non-cancer)	
Heptachlor Epoxide	ND	ND	ND	0	1			3.12E+1	3.16E+2	
Methoxychlor	ND	ND	ND	0	1			--	1.22E+5	
INORGANIC										
Antimony	ND	17.5	ND	0	2	2.5	17.5	--	2.92E+3	ECO2
Arsenic	3.7	5.1	3.87	2	2	0.15	3	4.87E+1	2.19E+3	
Barium	24.8	42.9	30.37	2	2	2	10.4	--	5.11E+5	
Beryllium	0.5	0.77	0.59	2	2	0.1	0.85	1.98E+1	3.65E+4	
Cadmium	ND	ND	ND	0	2	0.4	1.5	--	3.65E+3	
Chromium	54.9	123	74.3	2	2	0.8	6.8	--	3.65E+4	ECO2
Cobalt	4.7	9	5.87	2	2	0.5	4.1	--	--	HUM
Copper	189	343	220	2	2	0.5	5.2	--	–	YES
Lead	144	308	170	2	2	1.3	12.1	--	--	YES
Manganese	186	461	223	2	2	16	106	--	3.65E+4	ECO2
Mercury	0.16	0.4	0.28	2	2	0.04	0.06	--	2.19E+3	ECO2
Nickel	9.4	15	10.9	2	2	1.05	5.2	--	1.46E+5	
Selenium	ND	ND	ND	0	2	0.08	0.33	--	3.65E+4	
Silver	1	1	1	1	2	0.33	1.4	--	3.65E+4	ECO4
Vanadium	37.4	68.3	41.7	2	2	1.13	15.2	--	5.11E+4	ECO2
Zinc	127	211	154	2	2	3.1	16	--	2.19E+6	ECO2
Cyanide	0.69	1.2	0.8	2	2	0.19	0.7	--	1.46E+5	ECO2

1 - Maximum values are derived from both CDM Federal sampling results and sampling results presented in the interim Remedial Investigation Report (ABB Environmental Services, Inc.; April 1992).
2 - Values obtained from "Risk Assessment Handbook (Attachments E)", Automated Sciences Group, Inc.; September 1994; Attachment F revised D6cember 23. 1994.
-- - HEC values are not presented for the indicated parameters.
ND - Not Detected
NL - Compounds not listed In MMR HEC Tables dated 12/23/94.
YES - Compound Is considered under both human health and ecological risk evaluation.
EC01- Compound concentration exceeds USEPA Ambient Water Quality Criteria.
EC02- Compound concentration exceeds MMR Hazard Equivalent Concentration.
EC03- Compound concentration exceeds Ontario Ministry of the Environment Sediment Quality Guidelines.
EC04- Compound concentration exceeds NOAAERL value.

Table 2-15
Reference Doses (RfDs) and
Cancer Slope Factors (CPFs)
for Identified Contaminants of Concern

AOC CS-10/FS-24
Massachusetts Military Reservation

COC	Ingestion		Inhalation	
	CSF	RfD	CSF	RfD`
Benzo(a)anthracene	7.30E-01	na	na	na
Benzo(b)fluoranthene	7.30E-01	na	6.10E+00	na
Benzo(k)fluoranthene	7.30E-02	na	na	na
Benzo(a)pyrene	7.30E+00	na	6.10E+00	na
Benzo(g,h,l)perylene	na	4.00E-02	na	na
Bis(2-ethylhexyl)phthalate	1.40E-02	2.00E-02	na	na
Dibenz(a,h)anthracene	7.30E+00	na	na	na
Indeno(w,2,3-cd)pyrene	7.30E-01	na	na	na
2-Methylnaphthalene	na	na	na	na
4-Nitrophenol	na	na	na	na
Pyrene	na	3.00E-02	na	na
Aroclor-1248	7.70E+00	na	na	na
Aroclor-1254	7.70E+00	na	na	na
Dieldrin	1.60E+01	5.00E-05	1.61E+01	na
Endrin Ketone	na	na	na	na
Endosulfan Sulfate	na	na	na	na
Arsenic	na	3.00E-04	1.50E+01	na
Beryllium	4.30E+00	5.00E-03	8.40E+00	na
Cadmium	na	5.00E-04	na	na
Cobalt	na	na	na	na
Copper	na	na	na	na
Lead	na	na	na	na
Managenese	na	5.00E-03	na	na
Mercury	na	3.00E-04	na	8.57E-05
Zinc	na	3.00E-01	na	na

Source: Risk Assessment Handbook (Attachment E)

TABLE 2-16
CHEMICAL-SPECIFIC ARARS, CRITERIA, ADVISORIES, AND GUIDANCE

CS-10/CFS-24 SOURCE AREA RECORD OF DECISION
MASSACHUSETTS MILITARY RESERVATION

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
SOIL				
Federal	USEPA Risk Reference Doses (RfDs)	To Be Considered	RfDs are considered the levels unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure for a lifetime.	USEPA RfDs are used to calculate risk-based STCLs for noncarcinogens in various media.
	USEPA Carcinogen Assessment Group, Cancer Slope Factors (CSFs)	To Be Considered	CSFs represent the most up-to-date information on cancer risk from USEPA's Carcinogen Assessment Group.	USEPA CSFs are used to cumpute the cancer risk-based STCLs for certain chemicals.

Notes:

ARAR = Applicable or Relevant and Appropriate Requirement
CSFs = Cancer Slope Factors
RfDs = Reference Doses
STCL = Soil Target Cleanup Level
USEPA = U.S. Environmental Protection Agency

TABLE 2-17
CHEMICAL-SPECIFIC ARARS, CRITERIA, ADVISORIES, AND GUIDANCE

CS-10/CFS-24 SOURCE AREA RECORD OF DECISION
MASSACHUSETTS MILITARY RESERVATION

REQUIRMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal			
RCRA Standards for Owners and Operators of Hazardous Waste TSDF Facilities (40 CFR Part 264)	Applicable	Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations. The relevant and appropriate provisions of 40 CFR Part 264 are incorporated by reference.	Source area soils and sediments will be temporarily stockpiled on- site in accordance with state hazardous waste storage regulations.
RCRA Identification and Listing of Hazardous Wastes; Toxicity Characteristic (40 CFR 261.24)	Applicable	These requirements identify the maximum concentrations of contaminants for which the waste would be a RCRA characteristic waste because of its toxicity. The analytical test set out in Appendix II of 40 CFR Part 61 is referred to as the Toxicity Characteristic Leaching Procedure (TCLP).	Excavated source area soils and sediments will be analyzed by the TCLP to determine whether they are characteristic hazardous waste under RCRA. Soils and sediments that are determined to exceed TCLP allowable concentrations and therefore be hazardous will be disposed off-site in a RCRA Subtitle C TSDF. Soils and sediments that are determined to be below TCLP allowable concentrations and therefore nonhazardous (and that are determined to contain contaminant concentrations below MADEP MCP Method 1 S-1/GW-1 Standards for pesticides and Massachusetts Permitted Soil Recycling Facility Summary Levels) will be treated at the on-Site cold mix emulsion asphalt batching plant.
CWA National Pollution Discharge Elimination System (NPDES), 33 U.S.C. 1342; 40 CFR Parts 122-125, 131, 136)	Applicable	The NPDES permit program specifies the permissible concentration or level of contaminants in the discharge from any point source, including the channeling of site runoff, to United States waters.	Remedial activities will be controlled to meet NPDES discharge requirements including requirements for surface and storm water runoff.

State			
Massachusetts Air Pollution Control Regulations (310 CMR 7.00)	Applicable	These regulations set emission limits necessary to attain ambient air quality standards.	Remedial activities will be conducted to meet the standards for visible emissions (310 CMR 7.06); dust, odor, construction, and demolition (310 CMR 7.09); noise (310 CMR 7.10); and volatile organic compounds 7.18). If these standards are exceeded, emissions will be managed through engineering controls.
Massachusetts Surface Water Quality Standards	Relevant and Appropriate	These regulations specify the permissible concentrations or levels of contaminants in the discharge from any point source including the channeling of site runoff to Massachusetts state waters.	Remediation activities will be controlled to meet Massachusetts surface water quality standards including requirements for surface and storm water runoff.
MADEP Interim Remediation Waste Policy for Petroleum Contaminated Soils (WSC-94-400)	TBC	This policy outlines management practices for reuse, recycling, disposal, storage and transport of petroleum contaminated soils.	Excavated source area soils and sediments will be analyzed to determine whether they contain contaminant concentrations below the Massachusetts Permitted Soil Recycling Facility Summary Levels set out in this Policy. Soils and sediments that are determined to contain contaminant concentrations above these Permitted Soil Recycling Facility Summary Levels will be disposed off-site in a licensed TSDF. Soils and sediments that are determined to contain contaminant concentrations at or below these levels (and that are determined to be below RCRA TCLP allowable concentrations and to contain contaminant concentrations below MCP Method 1 S-1/GW-1 Standards for pesticides) will be treated at the on-Site cold mix emulsion asphalt batching plant.

Notes:

ARAR = Applicable or Relevant and Appropriate Requirement
AOC = Area of Contamination
CFR = Code of Federal Regulations
CMR = Code of Massachusetts Regulations
MADEP = Massachusetts Department of Environmental Protection
MCP = Massachusetts Contingency Plan
ppmw = parts per million by weight
RCRA = Resource Conservation and Recovery Act
TCLP = Toxicity Characteristic Leaching Procedure
TSDF = treatment, storage or disposal facility

TABLE 2-18
LOCATION-SPECIFIC ARARS, CRITERIA, ADVISORIES, AND GUIDANCE

AOC CS-10/FS-24 SOURCE AREA RECORD OF DECISION
MASSACHUSETTS MILITARY RESERVATION

LOCATION	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
OTHER NATURAL RESOURCES				
State	Massachusetts Endangered Wildlife and Wild Plants (321 CMR 8.00)	Applicable	The Commonwealth of Massachusetts has authority to research, list, and protect any species deemed endangered, threatened, or of concern. These species are listed as either endangered, threatened, or species of special concern in the regulations. The Massachusetts lists may differ from the federal lists of endangered species. Three state-listed species (grasshopper sparrow, upland sandpiper, and northern harrier) are known to inhabit the grassland areas of MMR. Actions must be conducted in a manner that minimizes the effect on Massachusetts-listed endangered species and species listed by the Massachusetts Natural Heritage Program.	Endangered or threatened species in the area of AOC CS-10/FS-24 will be identified during the design. Remedial activities will not adversely affect listed species.

Notes:

AOC = Area of Contamination
ARAR = Applicable or Relevant and Appropriate Requirement
CMR = Code of Massachusetts Regulations
USEPA = U.S. Environmental Protection Agency

TABLE 2-18
LOCATION-SPECIFIC ARARS, CRITERIA, ADVISORIES, AND GUIDANCE

AOC CS-10/FS-24 SOURCE AREA RECORD OF DECISION
MASSACHUSETTS MILITARY RESERVATION

LOCATION	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
WETLANDS				
Federal	Protection of Wetlands - Executive Order 11990 (40 CFR Part 6, Appendix A)	Applicable	Appendix A of 40 CFR Part 6 sets forth USEPA policy for carrying out the provisions of Executive Order 11990. Federal agencies are required to minimize the destruction, loss or degradation of wetlands, and preserved and enhance the natural and beneficial values of wetlands. Appendix A requires that no remedial alternatives adversely affect a wetland if another practicable alternative is available.	Excavation of contaminated soils and sediments will be performed so as to minimize adverse impacts on the wetlands in the vicinity of the Eastern Storm Sewer Outfall Drainage Ditch (Detail E). Any portion of these wetlands that is adversely affected will be restored or replaced.
	Clean Water Act (CWA) Section 404(b)(i) Guidelines for Specification of Disposal Sites for Dredge or Fill Material (33 U.S.C. 1344; 33 CFR Parts 320-323; 40 CFR Part 230)	Applicable	CWA Section 404 regulates the discharge of dredged or fill material into United States waters, including wetlands. The purpose of Section 404 is to ensure that proposed discharges are evaluated with respect to impacts on the aquatic ecosystem. The Section 404 regulations maintain that no discharge of dredged or fill material is permitted if practicable alternatives that would have less negative impact on the wetland available. If there is no practicable alternative, impacts must be mitigated.	Excavation of contaminated soils and sediments will be performed so as to mitigate negative impacts on the wetlands in the vicinity of the Eastern Storm Sewer Outfall Drainage Ditch (Detail E). Any portion of these wetlands that is negatively impacted will be restored or replaced.
State	Massachusetts Wetlands Regulations (310 CMR 10.00)	Applicable	These regulations apply to all activities that will remove, fill, dredge or alter any inland and coastal wetland area subject to protection under M.G.L. Chapter 131, Section 40, or alter a buffer zone within 100 feet of any such area.	Excavation of contaminated soils and sediments will be performed in such a manner that the wetlands in the vicinity of the Eastern Storm Sewer Outfall Drainage Ditch (Detail E) are not adversely impacted.

APPENDIX C— RESPONSIVENESS SUMMARY

Intentional Blank Page

RESPONSIVENESS SUMMARY

RECORD OF DECISION
AREA OF CONTAMINATION CS-10/FS-24
SOURCE AREAS

MASSACHUSETTS MILITARY RESERVATION
CAPE COD, MASSACHUSETTS

JULY 1999

Intentional Blank Page

CONTENTS

Intentional Blank Page

PREFACE

This Responsiveness Summary has been prepared to meet the requirements of Sections 113(k)(2)(B)(iv) and 117(b) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), which requires response to ". . . significant comments, criticisms, and new data submitted in written or oral presentations" on the Remedial Investigation (RI), Feasibility Study (FS), the Proposed Plan, or other information included in the Administrative Record for a specific operable unit. The purpose of this Responsiveness Summary is to document the Air Force Center for Environmental Excellence's (AFCEE's) responses to questions and comments expressed during the public comment period by the public, potentially responsible parties, and governmental bodies in written and oral comments regarding all the elements of the Administrative Record for Source Operable Units at CS-10/FS-24 Areas of Contamination (AOCs) at the Massachusetts Military Reservation (MMR).

AFCEE published a notice and brief analysis of the Proposed Plan in the *Falmouth Enterprise*, the *Mashpee Enterprise*, the *Bourne Enterprise*, the *Sandwich Enterprise*, and the *Cape Cod Times* on September 4, 1998. AFCEE made the following documents available for public review at the U.S. Coast Guard library at MMR and the main public libraries in Bourne, Falmouth, Mashpee, and Sandwich, Massachusetts:

- Remedial Investigation reports on January 14, 1998;
- Focused Feasibility Study on September 10, 1998; and,
- Proposed Plan on September 8, 1998.

The Proposed Plan is part of the Administrative Record available for public review at the AFCEE Installation Restoration Program (IRP) office at MMR and the Falmouth Public Library.

From September 14, 1998, to October 14, 1998, AFCEE conducted a 30-day public comment period to accept public comments on the preferred alternatives presented for the Area of Contamination (AOC) in the Proposed Plan. At the request of the public, the comment period was extended for 30 days, closing on November 13, 1998. On September 10, 1998, AFCEE held a public meeting at the Sandwich Public Library, Sandwich, Massachusetts, to present and discuss the Proposed Plan. On October 1, 1998, AFCEE held a Public Hearing at the Sandwich Public Library to accept verbal comments on the Proposed Plan. Several residents and local officials attended the hearing and provided verbal comments. AFCEE's responses to the comments received at the hearing and during the public comment period are included in Section 3 of this Responsiveness Summary. A transcript of the October 1, 1998, Public Hearing is included in Appendix D of the Record of Decision (ROD).

This Responsiveness Summary is organized into the following sections:

1. "Overview of Remedial Alternatives Considered in the Feasibility Study Including the Selected Remedy." This section briefly outlines the remedial alternatives evaluated in detail in the Feasibility Study and presented in the Proposed Plan, including AFCEE's selected remedy.

2. “Background on Community Involvement.” This section provides a brief history of community involvement and AFCEE’s initiatives to inform the community of site activities.

3. “Summary of Comments Received During the Public Comment Period and AFCEE Responses.” This section provides AFCEE’s responses to verbal and written comments received from the public and not formally responded to during the public comment period. Copies of the comment letters are included in Attachment A of this Responsiveness Summary. A transcript of the October 1, 1998, Public Hearing is included in Appendix D of the ROD.

1. OVERVIEW OF REMEDIAL ALTERNATIVES CONSIDERED IN THE FEASIBILITY STUDY INCLUDING THE SELECTED REMEDY

The Feasibility Study assessed how well the following five alternatives would meet the evaluation criteria of the National Oil and Hazardous Substances Pollution Contingency Plan while controlling migration of contaminants from surface and subsurface soils to groundwater at AOC CS-10/FS-24.

- NO Action
- Limited Action
- Excavation and On-site Asphalt Batching/In Situ Thermally Enhanced Soil Vapor Extraction/Environmental Monitoring
- Excavation and Off-site Asphalt Batching/In Situ Thermally Enhanced Soil Vapor Extraction/Environmental Monitoring
- Excavation and Off-site Landfill Disposal/In Situ Thermally Enhanced Soil Vapor Extraction/Environmental Monitoring

1.1 NO ACTION

As required by the CERCLA, the No Action alternative was evaluated as a baseline against which to compare other alternatives. No remedial action, monitoring, further investigation, or 5-year site reviews would be performed as part of this alternative. No action would be taken to maintain site access restrictions (security fencing and military guard posts) that currently limit potential human exposure to site contaminants.

1.2 LIMITED ACTION

The Limited Action alternative at AOC CS-10/FS-24 includes the following key components:

- Environmental monitoring.
- Maintaining institutional controls that restrict site access and limit potential human exposure to contaminants.
- Performing 5-year site reviews.

1.3 EXCAVATION AND ON-SITE ASPHALT BATCHING/IN SITU THERMALLY ENHANCED SOIL VAPOR EXTRACTION/ENVIRONMENTAL MONITORING

The Excavation and On-site Asphalt Batching/In Situ Thermally Enhanced Soil Vapor Extraction (SVE)/Environmental Monitoring alternative at AOC CS-10/FS-24 includes the following key components:

- Mobilization and site preparation.

Intentional Blank Page

2. BACKGROUND ON COMMUNITY INVOLVEMENT

AFCEE has met and exceeded the federal community involvement requirements of Superfund. These requirements include preparing a Community Relations Plan; establishing information repositories; establishing and maintaining an Administrative Record; providing public notice on information availability; conducting a Public Hearing and a comment period upon release of the Proposed Plan; and preparing a Responsiveness Summary. In addition to these required activities, AFCEE conducted informational meetings and poster sessions, issued fact sheets and news releases, and conducted a site tour to keep the community and other interested parties informed of activities at the nine AOCs covered in this ROD.

Throughout the history of MMR's IRP, community concern and involvement have been high. The National Guard Bureau (NGB), AFCEE, U.S. Environmental Protection Agency (USEPA), and Massachusetts Department of Environmental Protection (MADEP) have kept the community and other interested parties apprised of data and site activities through informational meetings, fact sheets, news releases, public hearings, telephone calls, flyers, and advisory team meetings.

AFCEE took several steps to notify the public, through the news media, of the availability of the Proposed Plan and the opportunity to comment, as well as the public information meeting and the public hearing conducted commensurate with the release of the Proposed Plan. AFCEE issued a notice and brief analysis of the Proposed Plan which was published in the *Falmouth and Mashpee Enterprises,* the *Bourne and Sandwich Enterprises,* and the *Cape Cod Times,* on September 4, 1998. Additional advertisements announcing the Public Hearing were published in the *Falmouth and Mashpee Enterprises* on September 18, 1998; the *Cape Cod Times* on September 21, 1998; and the *Bourne and Sandwich Enterprises* on September 25, 1998. A notice that the public comment period had been extended 30 days was published in the *Cape Cod Times* on October 19, 1998, and rerun with a correction on October 22, the *Falmouth and Mashpee Enterprises* on October 20, 1998; and the *Bourne and Sandwich Enterprises* on October 23, 1998. A notice that additional Public Hearings would be conducted was published in the *Falmouth and Mashpee Enterprises* on October 30, 1998; the *Cape Cod Times* on November 3, 1998; and the *Bourne and Sandwich Enterprises* on November 6, 1998. Before the start of the comment period, AFCEE made the RI reports, the FS, and the Proposed Plan available for public review at the U.S. Coast,Guard library at MMR and the main public libraries in Bourne, Falmouth, Mashpee, and Sandwich, Massachusetts. The Proposed Plan was added to the Administrative Record available for public review at the AFCEE IRP Office at MMR and at the Falmouth Public Library. In addition, AFCEE mailed the fact sheet summarizing the engineering evaluation/cost analysis to each of the approximately 3,000 people on its comprehensive community mailing list.

From September 14, 1998, to October 14, 1998, AFCEE conducted a 30-day public comment period to accept public comments on the remedial action alternatives presented for the AOC in the Proposed Plan. At the request of the public, the comment period was extended for 30 days, closing on November 13, 1998. On September 10, 1998, AFCEE held a public meeting at the Sandwich Public Library in Sandwich, Massachusetts, to present and discuss the Proposed Plan. On October 1, 1998, AFCEE held a Public Hearing to accept verbal comments on the Proposed Plan. Several residents and local officials attended the hearing and provided 41 verbal comments. AFCEE's responses to the comments received at the hearing and during the public comment period are included in Appendix C. A transcript of the October 1, 1998, Public Hearing is included in Appendix D.

3. SUMMARY OF COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND AFCEE RESPONSES

AFCEE received 41 verbal comments from 7 people during the Public Hearing on October 1, 1998, and 59 written comments from 10 people during the public comment period (see Attachment A to this Appendix). The following paragraphs summarize the comments and provide AFCEE's responses. Those who commented are listed below.

Provided comments at hearing:

Susan Walker, Sandwich, Massachusetts

Daniel Drum, Forestdale, Massachusetts

Todd Borci, U.S. Environmental Protection Agency (USEPA)

Pamela McClung, Forestdale, Massachusetts

Sharon Judge, Sandwich, Massachusetts

Annie Sullivan, Forestdale, Massachusetts

Joel Feigenbaum, Plume Management Team, Sandwich, Massachusetts

Provided written comments:

Richard Hugus, Otis Conversion Project, Falmouth, Massachusetts

Sharon and Richard Judge, Sandwich, Massachusetts

Pamela McClung, Forestdale, Massachusetts

David Dow, Cape Cod Group-Sierra Club, East Falmouth, Massachusetts

Walter J. Jaworski, Pocasset, Massachusetts

Joel Feigenbaum, Sandwich, Massachusetts

Catherine Paris, Forestdale, Massachusetts

Suzanne Sevco, Forestdale, Massachusetts

Paul Zanis, Forestdale, Massachusetts

The comments provided have been grouped into 17 subject categories as follows:

1. Request extension of the comment period so that more information could be provided to the public about the asphalt-batching process.
2. Comments requesting that the cleanup proceed as quickly as possible.
3. Comments supporting the Proposed Plan for CS- 10/FS-24.
4. Comments stating that the AFCEE preferred alternative for CS- 10/FS-24 is insufficient.
5. Comments concerning other remedial alternatives.
6. Comments concerning the RI and the extent of contamination at CS- 10/FS-24.
7. Comments concerning the sampling for explosives.
8. Comments concerning the sampling of the drainage ditch and the residential neighborhood.

9. Comments concerning the sampling for radionuclides at the Boeing-Michigan Aeronautical Research Center (BOMARC) site.
10. Comments concerning the disposition of the missiles at the BOMARC site.
11 Comments concerning the asphalt-batching process.
12. Comments concerning air quality monitoring and health and safety issues during implementation of the asphalt-batching alternative.
13. Comments concerning the covering of contaminated soils during implementation of the asphalt-batching alternative.
14. Comments concerning the fate of contaminants after the asphalt batch has been placed into the environment.
15. Comments concerning risk to humans during implementation of the asphalt-batching alternative.
16. Comments concerning the disposition of the existing buildings and asbestos.
17. Miscellaneous comments.

1. An extension to the public comment period so that more information could be provided to the public about the asphalt batching and soil vapor extraction processes was requested by four commentators: Pamela McClung, Forestdale; Richard Hugus, Otis Conversion Project; Joel Feigenbaum, Sandwich; and Sharon Judge, Sandwich.

Response: AFCEE extended the end of the public comment period, which began on September 14, 1998, from October 14, 1998, to November 13, 1998, to allow for further public review and comment. At the public's request, AFCEE compiled and distributed Fact Sheet #98-16, which describes the technology of the cold mix asphalt-batching process. A bibliography is provided in this fact sheet that provides additional information into the cold mix asphalt-batching process. The fact sheet is included in Appendix F of this ROD.

2. One commentator requested that the cleanup proceed as quickly as possible.

Public Hearing statement from Daniel Drum, Forestdale

Comment: I'm concerned that this pollution site has continued to exist as long as it has. And (I am) responding to the previous person's comment that they wanted to extend the informational meetings and comment period. I would like to see this cleanup plan go ahead as quickly as is reasonably possible with all the protections in place.

Response: AFCEE intends to implement a cleanup plan as expeditiously as possible. At the same time, it is imperative that the public has every opportunity to provide input to the process.

3. One commentator expressed support for the Proposed Plan for AOC CS-10/FS-24.

November 9, 1998, letter from Walter J. Jaworski, Pocasset

Comment: After reading the article regarding the cleanup of the BOMARC Missile Site plus the work your organization has done to clean up the entire pollution problem of the base, I want to say "THANKS" and "CONGRATULATIONS" for doing such an outstanding job under extreme adverse conditions.

You and your staff have done a great deal of hard work trying to satisfy so many environmental activists especially when they did not do their homework when they purchased their homes close to the military installation.

Many of my friends in the Upper Cape Area who have been identified as the "SILENT MAJORITY" think that progress is being made on the entire pollution/contamination problem and you should be commended on the difficult task that you face each and every day.

Thanks again in advance to you and your staff and your efforts in this matter are truly appreciated.

Response: AFCEE appreciates your support.

4. Four letters from five commentators stated that the Proposed Plan for AOC CS-10/FS-24 is unacceptable.

November 8, 1998, electronic mail from Joel Feigenbaum, Plume Management Team, Sandwich

Comment: The people of the Upper Cape have been subject to a wide range of environmental insults from Otis/Edwards/MMR for nearly 50 years. It is time that toxic substances be entirely removed from our air, water and soil--not redispersed. The proposed action does not meet the criterion public acceptability.

November 8, 1998, and November 9, 1998, electronic mail from Richard Hugus, Otis Conversion Project

Comment: On-site asphalt batching has been chosen as the remediation method for contaminated soil at these sites. Asphalt batching is no more than a process of reducing the concentration of contaminants by distributing them into a wider environment. This is not a cleanup. The proposed plan is unacceptable.

November 12, 1998, electronic mail from Paul Zanis, Forestdale

Comment: Cold asphalt batching is out for several common sense reasons. First, cold asphalt batching doesn't mix well. Dry clumps and poor encapsulating is common with this process. Second, have you ever seen cold patching of potholes? It doesn't last, it crumbles and it's a temporary fix. Three, dispersing of contaminants is not a cleanup. Four, too much time will be spent storing contaminated soils with the proven result that it will not be properly handled. AFCEE and its personnel has the moral obligation to protect the citizens of Cape Cod no matter what the cost. AFCEE's remedy does not minimize risk to human health. It's the cheap way out. Please reconsider.

November 13,1998, electronic mail from Sharon and Richard Judge, Sandwich

Comment: We feel that all contaminated soil should be taken off-site and off-Cape. As we noted in our comments regarding CS-16/CS-17, cold-mix asphalt batching is unacceptable for several reasons. 1. Due to the enormity and complexity of this Superfund site, we must "eliminate" risk whenever possible vs. just "minimizing" risk to the surrounding communities, especially given our high rates of disease here. 2. Large amounts of soil are expected to exceed acceptable standards for asphalt batching resulting in a great deal of soil that will be taken off-site anyway. 3. The process of asphalt batching contaminated soil requires an extensive and tedious process to determine the correct percentage of emulsion. 4. On-site asphalt batching would encourage unnecessary paving on MMR. 5. Asphalt batched underpaving deteriorates more quickly than normal asphalt. 6. There has not been an adequate assessment of the risks of human exposure during the entire process of asphalt batching, from excavation to end product, as well as the risk of exposure to contaminants in the environment when the asphalt batched pavement deteriorates.

Response: The previous four comments can be addressed in one response.

AFCEE has carefully implemented the CERCLA FS process that examines several criteria including protection of human health and the environment and meeting federal and state requirements, provides long-term effectiveness and reduction of mobility, toxicity, or volume; and provides short term effectiveness, implementability, and cost-effectiveness. After considering the tradeoffs between the solutions, AFCEE decided on the on-site remedial action described in the ROD. This remedial action will involve excavation and on-site asphalt batching of contaminated soils at six of the nine sites, soil vapor extraction at one site, and environmental monitoring at two of the sites. For a further explanation of the process for selecting the remedial alternative, refer to the ROD.

The preferred method of remediating contaminated materials is to avoid moving them , off-site if the levels of contamination are conducive to safe treatment on-site. The intent of the asphalt batching is not to disperse the contamination but to meet the CERCLA goal of immobilizing the contaminants.

USEPA's preference for remedial action, as indicated in Section 121 of CERCLA, is for actions that permanently reduce the volume, toxicity, or mobility of contaminants and to do so through methods that favor on-site treatment. The reason for this preference by USEPA is that on-site treatment minimizes additional risks associated with transporting hazardous waste and prevents the contamination of new sites if improper disposal occurs. On-site treatment represents a risk management strategy that provides optimal risk reduction.

It is not possible to remove all by-products of facility operations from MMR. Instead, risks must be managed and tradeoffs between risk, cost, and stakeholders' acceptance must be balanced. In this process, technical information, regulatory information, and public concerns and preferences are considered and weighed, and decisions are made. It is clearly understood that the citizens of Cape Cod do not want MMR waste in their backyard, but neither does anyone else; and that, along with the cost of complete removal of all contaminated media, is where the problem lies. With this in mind, and considering the wealth of technical information and data presented to date, the proposed remedy remains an optimal remedy for managing site risks.

Asphalt batching is a recycling technology that is approved by federal and state regulatory agencies. Asphalt batching satisfies the federal guideline for reduction of contaminant mobility through treatment (i.e., the encapsulation of contaminated soil particles with asphalt), uses a resource recovery/alternative treatment technology, and is cost-effective. The cold-mix asphalt batching fact sheet (#98-16) is provided in Appendix F of the ROD.

Although everyone would like to totally eliminate risks if possible, the total elimination of risks is not possible because, by their nature, chemical—seven when used and disposed of properly—pose some risk if exposure occurs. Therefore, the goal of environmental remediation is to reduce risks to levels that are expected to result in no adverse health effects to the most chemically sensitive or most exposed individuals in the affected population. The purpose of the risk assessment is to ensure that estimates of risk are based on current toxicological knowledge about what concentrations result in adverse effects and knowledge of population characteristics that identify potentially exposed individuals. At any point in the risk assessment process where risk management decisions about health protectiveness must be made, estimates of risk are always biased toward health protectiveness to provide an added measure of safety to any estimate of risk used to make cleanup decisions.

Excavated soils will be sampled before processing to ensure they meet the Massachusetts soil recycling regulatory limits. Fact Sheet #98-16 mentions extensive testing is necessary to determine the exact percentage of emulsion mix; however, this is not considered to be a significant problem. Although some soil samples collected during the RI have concentrations of three contaminants that exceed the soil recycling regulatory limit (TPH at Details A, B, D, and E; total SVOCs at Details B, E, and F; and dieldrin at Details E and F); most soil concentrations do not exceed these limits (see Table B-1 in the Feasibility Study Report for CS-10). The volume of soils in this category is expected to be small, and it is anticipated that a correspondingly small volume of soils will have to be transported off-site. However, costs have been provided in the ROD in the event that large quantities of soil are indeed unsuitable for asphalt-batching and have to be transported off-site.

There are many locations at MMR that require the utilization of a paving system to provide secure and stable storage for materials and equipment. This previously identified need will ensure that no unnecessary paving operations will be performed.

Previous experience with cold asphalt batching at MMR has not indicated any of the problems mentioned in the previous comments. AFCEE will make every attempt to minimize the time during which soil is stockpiled and will ensure that it is properly covered during that time. AFCEE expects that the contaminants will be completely encapsulated during processing. The material that is produced in the cold asphalt-batching process will be used as subbase material and will have a wear layer over it that contains no contaminants, thus protecting it from the normal forces that may cause degradation. The asphalt subgrade paving will maintain its inherent stability for many years, and the materials will remain encapsulated even if some cracking of the wear cover occurs. The CERCLA process requires periodic reviews of the effectiveness of the final remedial activity. This process will address concerns over long-term effectiveness.

CERCLA provides for an evaluation of risks associated with remedial action as part of the evaluation of long- and short-term effectiveness. This evaluation is often qualitative (i.e., the risks are identified; however, they are not measured) in nature when a proven technology, such as asphalt batching, is being used. Only when new or untested technologies are used in remediation does a quantitative assessment (i.e., the risks are not only identified, they also are measured) become necessary. Risks are generally known for proven technologies and are mitigated through standard administrative and engineering controls. These controls are designed to minimize exposure to workers who, by virtue of the activities they perform, are likely to receive the highest dose of any potential receptor during remediation. Because workers are exposed through the same exposure routes (and often additional exposure routes) as other potential receptors (e.g., off-site residents), administrative and engineering efforts to control exposure to workers are considered to be protective of all potential receptors during remediation.

5. Two commentators questioned why other alternatives were not considered for CS-10/FS-24.

Public Hearing statement and September 25, 1998, electronic mail from Sharon Judge, Sandwich

Comment: I haven’t heard anything about thermal treatment of the soil. I'm not convinced that all alternatives have been explored adequately. I still have more questions about soil vapor extraction and other things.

September 25, 1998, electronic mail from Sharon Judge, Sandwich

Comment: More in-depth information is needed regarding the alternatives not preferred by AFCEE. Given the fact that MMR is home to one of the worst USEPA superfund sites, the contamination should be taken off-site, off Cape Cod.

November 12, 1998, electronic mail from Paul Zan is, Forestdale

Comment: All contaminated soil must be removed off Cape to an approved site.

Response: AFCEE seriously considered the preference of local residents to excavate and remove contaminated soils off-site for treatment and disposal. This alternative, as well as soil vapor extraction, was evaluated and documented in the Focused Feasibility Study, which is available at the public libraries in Bourne, Sandwich, Falmouth, and Mashpee as well as at the U.S. Coast Guard Library on MMR and the Installation Restoration Program Office on base. After carefully considering the advantages, disadvantages, and uncertainties associated with each alternative, AFCEE determined that off-site treatment/disposal does not meet the CERCLA preference to conduct treatment and/or disposal on site. For further explanation of the alternatives evaluated and the process for selecting the remedial alternative, refer to the ROD.

6. Fifteen comments from four commentators were provided that requested a variety of information regarding the findings from the Remedial Investigation and the extent of contamination at CS-10/FS-24.

Public Hearing statement from Pamela McClung, Forestdale

Comment: On Page 4 of the Proposed Plan it reads 1992 and 1993 a final RI was performed to further characterize contamination and evaluate potential risk. Nine Source Areas were identified that warrant clean up. These Source Areas were close to a residential home, mine, and land in the process of being developed. At any time did you notify the town of Sandwich of the proximity of these Source Areas?

October 7, 1998, letter from Pamela McClung, Forestdale

Comment: Could you provide documentation that the Town of Sandwich was notified of the chemical contamination found at the nine Source Areas at the UTES on MMR?

Response: The previous two comments can be addressed with one response. Yes, the AFCEE Community Involvement group will supply documentation. Contact Vanessa Musgrave or Douglas Karson at (508) 968-4670. General information and a summary on community involvement can also be found in Section 2 of this Responsiveness Summary.

Public Hearing statement from Pamela McClung, Forestdale

Comment: How far down underneath the water was testing done on sources E and F?

Response: The sediments on the bottom of the pond were sampled.

October 7, 1998, letter from Pamela McClung, Forestdale

Comment: When an area is tested for chemicals and reads positive, how far down and out do you continue to go until you get a negative reading?

Response: The lateral and vertical extent of soil sampling is determined on a site-by-site basis. In general, a site will have samples taken until results reach a level below regulatory concern.

Comment: Does more testing need to be done under the water at Source F? Is one foot deep enough?

Response: During the remedial activities at Detail F, the sediments will be removed until the cleanup standards are met.

Comment: Do you know the highest recorded level of water at East Pond?

Response: MMR does not record the water level elevations in East Pond.

Comment: After these nine Source Areas are considered clean, are there any more areas at the UTES that need testing and cleaning up? If so, how many?

Response: Based on the investigation and sampling conducted, the nine Source Areas are all of the areas proposed for rernediation at the UTES. Groundwater is being addressed as a separate operable unit. Drainage sumps were addressed as part of the Drainage Structure Removal Program.

Comment: Why doesn't the drainage control structure that comes from East Pond under Greenway into my backyard appear on the Source F map on page thirteen?

Response: Figure 5 for Detail F on p. 13 of the CS-10/FS-24 Proposed Plan is intended to illustrate the sampling and analytical program with the results of contaminants exceeding cleanup goals. The figure was not designed to show all the physical features of this area. Also, as a point of clarification, drainage structures, as defined in the Drainage Structure Removal Program, are drainage sumps at buildings throughout MMR and not culverts and storm drains at other locations.

November 13, 1998, letter from Pamela McClung, Forestdale

Comment: I feel that additional testing needs to be completed at the CS-10/FS-24 sites at deeper depths than already completed (depths greater than 1 foot).

Response: MMR has completed sampling of soils at varying depths (depending on the site characteristics) from surface samples down to at least 99 ft deep. In response to requests from the public, additional sampling was performed for asbestos, explosives, and radiologicals. Also, at the request of the public, additional sampling was performed in the surrounding neighborhood for VOCs, SVOCs, pesticides/herbicides, PCBs, explosives, and metals. A summary of the results of this additional testing is provided in the ROD. The RI/FS (augmented by the Technical Memorandums for asbestos, explosives, radiological, and the off-site neighborhood sampling) provides sufficient information to make a decision on a site remedy without further delays associated with additional studies.

October 11, 1998, letter from David Dow, East Falmouth

Comment: Additional issues that need to be addressed for the CS-10 Source Area include potential downgradient ethylene dibromide (EDB) pollution associated with the BTEX contaminants (because EDB does not apparently biodegrade extensively at MMR under anaerobic conditions in the subsurface that accompany BTEX biodegradation and not all the BTEX has been degraded at CS-10).

Response: The groundwater contamination at CS-10/FS-24 is addressed in a separate study and is to be remediated by the Sandwich Road Fence treatment system.

Comment: Need an explanation for the nondetects for fuming nitric acid and hydrazine, since they were extensively utilized at the BOMARC site.

Response: Review of site historical information does not indicate any spills of nitric acid or hydrazine at the BOMARC site, and the analytical data support this information. The materials were carefully disposed of in such a manner that only nitrogen gas, water, carbon dioxide, calcium (from limestone in the disposal pit), nitrogen oxides, and nitrate were released.

November 11, 1998, letter from Suzanne Sevco, Forestdale

Comment: Is all the testing complete for any additional chemicals that may have been at the BOMARC in the past?

Response: AFCEE has completed sampling for additional parameters at various locations at the BOMARC site. A summary of the results of the additional sampling can be found in the ROD.

September 25, 1998, electronic mail from Sharon Judge, Sandwich

Comment: Why has the soil and water testing stopped at the MMR fence? This site is the closest to residential neighborhoods outside MMR than any other.

Response: After the limits of contamination are established, there is no need to continue the sampling program beyond that point. The investigation programs at MMR are designed to establish the limits of contamination and do not arbitrarily stop at the base boundary.

7. One commentator requested inform ation regarding sampling for explosives at CS-10/FS-24.

October 11, 1998, letter from David Dow, East Falmouth

Comment: Need to have sampling for explosive compounds (RDX, HMX, TNT, etc.) conducted at this site.

Response: Explosive sampling was conducted at this site this past summer (1998). The results have been approved by the regulatory agencies and indicate that explosive compounds in the samples collected at CS- 10/FS-24 are between the Method Detection Limits and the reporting limits of the laboratories and do not pose a health risk to the public.

8. Ten comments from six commentators were received requesting a variety of information regarding the sampling of the drainage ditch and the residential neighborhood.

Public Hearing statement from Susan Walker, Sandwich

Comment: You talked about researching how present residential land was used in the past. But you don't know how that residential land was used 20, 30, 40 years ago. And you can't be sure that your research is going to bring up all the answers, because it's a long time ago. Therefore, the yards in the neighborhood should have the soils sampled and tested.

Public Hearing statement from Pamela McClung, Forestdale

Comment: Was the land where Pebble Path and Belmont ever owned, occupied by the military and what was the use?

Comment: Will you test my children's play area where ammunition was found and when?

November 11, 1998, letter from Suzanne Sevco, Forestdale

Comment: A photo of the BOMARC Site in 1966 shows my land and trees have been removed. I would like my land tested for munitions and any chemicals.

Response: The previous four comments can be addressed with one response.

AFCEE is currently conducting an investigation to determine past ownership of property east of the current base boundary, adjacent to the CS-10 site, to determine historical ownership. Aerial photographs dating from 1943 indicate that the area adjacent to CS-10 was wooded until the late 1970s and apparently not used by the military. However, the Army Corps of Engineers has determined that the property to adjacent to the CS-10 property has been identified as a Formerly Used Defense Site (FUDS). Further investigations will be conducted separate to the FS-10 study.

At the time this response was prepared (February 1999), the Massachusetts Army National Guard (MARNG) was continuing to research and solicit information about the likelihood of ammunition being present in the Forestdale neighborhood adjacent to the CS-10/FS-24 site. The MARNG was also conducting metals sweeps of area yards, upon requests from neighborhood residents. Additional, up-to-date information can be obtained by contacting the Joint Program Office (JPO).

Public Hearing statement from Pamela McClung, Forestdale

Comment: Was the drainage structure that comes from source F under Greenway into the easement on my property at 18 Pebble Path removed, cleaned, or filled during the DSRP in 1996? Why was that not done?

Response: The culvert pipe emanating from Source Area “F” is not considered a drainage structure and, therefore, was not considered for removal during the DSRP. AFCEE filled the western end of the culvert pipe with concrete during the week of October 26, 1998, and the eastern end is scheduled for closure in early July 1999.

Comment: Was the soil in this easement tested for chemicals found in source F? Why not? And when will this testing be done?

Comment: After testing these areas clean, will you provide documentation from AFCEE stating that these areas are clean for all areas tested?

November 13, 1998, letter from Pamela McClung, Forestdale

Comment: I would like to be notified immediately concerning the soil test results taken from the drainage easement flowing from the BOMARC missile site onto my property (in writing).

In addition, I would like test results including chemical concentrations in writing from the independent laboratory conducting the test.

If contaminants are discovered in the above mentioned drainage structure what is the proposed cleanup method? Is it part of the larger cleanup effort?

October 11, 1998, letter from David Dow, East Falmouth

Comment: Area F culvert needs to be examined off base in the swale area that exists between two neighborhoods in Sandwich that are adjacent to the MMR (since the drainage basins and catchment areas at this site seem to have high levels of a variety of contaminants).

Response: The previous four comments can be addressed with one response.

AFCEE sampled the culvert area on October 30, 1998, and coordinated the sampling with the USEPA, MADEP, the Agency for Toxic Substance and Disease Registry, and the JPO. AFCEE collected surface soil samples at six locations in the swale. One sample was collected at the drainage pipe, another 25 ft away, and four more 200 ft apart. The samples were analyzed for VOCs, SVOCs, PCBs, pesticides, TPH, explosives, and metals. The results do not indicate any health concern, according to the Massachusetts Department of Public Health and the U.S. Agency for Toxic Substances and Disease Registry.

If contaminants had been discovered, the proposed cleanup method would have depended upon the types and levels of contaminants present. The types and levels of contaminants would have also determined the inclusion into a larger cleanup effort.

AFCEE will provide validated sampling results to document the clean areas.

November 13, 1998, electronic mail from Sharon and Richard Judge, Sandwich

Comment: In our opinion, this site has been "glossed over." Given the enormity and complexity of the site, we feel that ongoing public involvement is critical to a safe and thorough remediation process. All residences in the vicinity should have their property tested for contamination. There must be further investigation into past uses of the areas around the BOMARC site including the residential areas as several neighbors have reported finding shells, antique medicine bottles, etc. in their yards.

Response: The CS-10/FS-24 Remedial Investigation report was prepared based on an extensive and thorough sampling program that was reviewed and approved by MADEP and USEPA. At the public's request, AFCEE has performed additional sampling at AOC CS- 10/FS-24, as well as continued document and aerial photography research. In addition, AFCEE completed sampling of the drainage swale that ran from the CS -10 area on October 3 0, 1998, and reported validated results in December 1998. Those results indicated no public health threat, according to the federal Agency for Toxic Substances and Disease Registry and the Massachusetts Department of Public Health. The MARNG (as of February 1999) was continuing to look into the necessity and possibility of additional neighborhood sampling to investigate reports of the presence of ammunition. Up-to-date information on those efforts can.be obtained by contacting the MMR JPO.

9. Three commentators expressed concern about radionuclides at the BOMARC site.

Public Hearing statement from Sharon Judge, Sandwich

Comment: I think there has been inadequate testing of soil and water for radiologicals. Given the fact that to my knowledge the military has not been able to come up with the records, you've got to find a way, get the technical equipment - - I'm not satisfied with the equipment that's been used thus far to test the soil. There's been no water testing for radiologicals. I believe there should be a several-mile radius that should be tested. You should be able to test for the presence of radiologicals deep within the soil.

I"m not satisfied with the equipment that"s been used thus far to test the soil.

September 25, 1998, electronic mail from Sharon Judge, Sandwich

Comment: Most disturbing to me is the lack of information regarding radiologicals. Marty Aker explained to me that Oak Ridge is not done with their testing yet. The public comment period should not have begun until this testing was completed. The public needs more information on the method of testing as well as the extent of testing for radiologicals. The public would like to know why the water is not being tested for radiologicals.

November 13, 1998, electronic mail from Sharon and Richard Judge, Sandwich

Comment: More information is needed on the handling practices of the BOMARC missiles to properly comment on remediation efforts. Because we do not have adequate records, we must take extraordinary precautions in testing the silos and vicinity for radiologicals, rocket fuel and associated chemicals, etc. For instance, we noticed the utilidors on our bus tour of the site last weekend. It appeared the pipes led to each silo. When asked, Marty Aker said sampling in the past showed “some detections” but did not offer more information and said AFCEE would sample these utilidors in the next few weeks. We would like to know specifically which chemicals AFCEE will be testing for and we urge that the utilidors be tested for radiologicals.

We were shocked to learn that contaminated water has been sitting in the basement of some of these buildings for over 10 years! Even more shocking is that it has never been tested! The sumps must be tested as soon as possible. We are not satisfied that there has been adequate emphasis placed on the testing of water and soils for radiologicals. At the initial informational meeting on the BOMARC site this summer at the Forestdale school, the representative from Oakridge Labs demonstrated the detection equipment used to test for radiologicals. More technologically advanced equipment is needed to test the BONLARC site for radiologicals!

Public Hearing statement from Joel Feigenbaum, Plume Management Team, Sandwich

Comment: The possibility of radioactive substances from the BOMARC missiles has not been fully explored at this point.

Response: All of the preceding comments can be addressed with one response.

Testing for radionuclides was completed on October 23, 1998, at the BOMARC site. The Oak Ridge National Laboratory field team used five different instruments in their investigation, and samples were collected and analyzed at a fixed-base laboratory. All equipment and analytical methods that were used were state of the art.

The program to test for radionuclides was designed to determine if any materials could have been released at the areas where missiles were stored. Historical information does not indicate that radioactive materials were handled at these sites or released from the missiles; however, testing was done to verify this information.

In response to the concern about the extent of the testing, the standard practice in environmental investigations is to begin sampling at the potential Source Areas. If contamination is discovered at the potential Source Areas, the investigation can be expanded to any areas or media (such as groundwater) that could be impacted by the source. To date, there has been no information or data to suggest that groundwater has been contaminated with radionuclides.

An extensive report that includes a thorough statistical analysis, evaluation, and discussion of the results was released in January 1999. The data analyses contained in the report indicate that radioactive contamination is not present in areas where nuclear weapons might have been stored or maintained. Random samples collected in other areas also indicate that contamination is not present.

A separate study of the utilidors was conducted in December 1998 to augment the RI and DSRP studies of the utilidors. Samples collected from the utilidors were analyzed for VOCs, SVOCs, TPH, pesticides, PCBs, and metals. The results indicate that elevated concentrations of TPH and PCBs exist in the utilidors. Any remediation of the utilidors that is necessary will be addressed during their demolition.

10. Two commentators requested information regarding the disposition of the missiles at the BOMARC site.

Public Hearing statement from Sharon Judge, Sandwich

Comment: I have a lot of questions about the missiles and if they have been accounted for. There needs to be more open discussion and public meeting on the potential for radiologicals unless the military has found the records. Have all the missiles been accounted for?

November 9,1998, electronic mail from Richard Hugus, Falmouth

Comment: Six years of requests by this commenter and others for declassification of BOMARC operational records have proven fruitless. These records have been classified because nuclear warheads were deployed in the BOMARC facility's 50-some missiles. Incredibly, the Air Force, which operated the facility, claims to be unable to gain access to the BOMARC records. Pertinent information may be contained in these records about the handling and disposal of such hazardous substances as hypergolic and solid rocket fuels, jet fuels, cleaning solvents, munitions, and radioactive material. Without this information the public is unable to judge the adequacy of site and remedial investigations. The Record of Decision on CS-10 should be withheld until these records are produced, with fines under the Federal Facilities Agreement should the deadline for the Record of Decision be missed.

Response: AFCEE has attempted to locate documentation concerning the missiles at the BOMARC site without success. However, AFCEE will continue to search for records regarding the missiles.

The investigations that have taken place at the BOMARC facility have included all the parameters expected to be found at the sites. Even without all of the records that, at one time, may have provided insight into the operations of the site, MMR believes that the program is comprehensive and addresses all the contaminants of concern.

11. Nine comments were received from six commentators requesting information about the asphalt hatching process.

Public Hearing statement from Todd Borci, USEPA

Comment: The USEPA has taken a look at what the state allowable levels are, and the existing data indicates that a lot of the soil will not be able to be asphalt batched. The USEPA will look at the sampling plans closely to make sure that things are done correctly and that the levels in the soils that are asphalt batched are below State requirements.

November 8, 1998, electronic mail from Joel Feigenbaum, Plume Management Team, Sandwich

Comment: It is admitted that many of the soils carry concentrations of toxics incompatible with asphalt treatment. Thus large amounts of soil will need to be transported to a dedicated treatment facility, hopefully far from human habitation. Since this operation will be carried out anyway, the alternative of transporting all of the soil in this fashion should be feasible.

Response: The previous two comments can be addressed with one response.

Excavated soils will be sampled before processing to ensure they meet the Massachusetts soil recycling regulatory limits. Fact Sheet #98-16 mentions extensive testing is necessary to determine the exact percentage of emulsion mix; however, this is not considered to be a significant problem. Although some soil samples collected during the RI have concentrations of three contaminants that exceed the soil recycling regulatory limit (TPH at Details A, B, D, and E; total SVOCs at Details B, E, and F; and dieldrin at Details E and F); most soil concentrations do not exceed these limits (see Table B-1 in the Feasibility Study Report for CS-10). The volume of soils in this category could be as great as 75%, and the soils will have to be transported off-site. Costs have been provided in the ROD in the event that large quantities of soil are indeed unsuitable for asphalt-batching and have to be transported off-site.

Public Hearing statement from Pamela McClung, Forestdale

Comment: On detail F when excavating the 50-foot area that shows six different sites with contaminated soil, each site having several chemicals, is there any special removal process?

Response: The remedial activities will have plans developed that will detail how the activities will be conducted. During the FFS process, it was determined that the contaminants of concern that are in the soils and sediments can be safely used for asphalt batching.

Comment: Does the asphalt mixing put chemicals into the air and does this have to be done on site?

Public Hearing statement from Joel Feigenbaum, Plume Management Team, Sandwich

Comment: There has been in a more detailed questioning no analysis has been shown of what kind of volatilization will take place during the actual soil batching process itself. And since these are very dangerous substances, and the batching is by definition a mixing process, there's some concern that batching will indeed cause material to enter the air that otherwise wouldn't.

Response: The previous two comments can be addressed with one response. The cold mix asphalt-batching process is designed not to introduce chemicals into the air. Both on-site and off-site asphalt-batching alternatives were investigated in the FFS, and the on-site alternative best met the requirements in the detailed analysis of alternatives and the comparative analysis of alternatives. More details concerning asphalt batching can be found in Fact Sheet #98-16, which is included in Appendix F of the ROD.

October 7, 1998, letter from Pamela McClung, Forestdale

Comment: How long will you be excavating at each Source Area, particularly Source E and F?

Response: The length of time to excavate each site has not been determined. Estimated times will be included in a schedule for these activities that is routinely developed as a part of the remedial action plans. The public will be notified before excavation begins.

September 25, 1998, electronic mail from Sharon Judge, Sandwich

Comment: The public needs more information on “asphalt batching.”

Response: At the public’s request, AFCEE compiled and distributed Fact Sheet #98-16 that describes the technology of the cold mix asphalt-batching process. A bibliography is provided in this fact sheet that provides additional information into the cold mix asphalt-batching process. Complete remedial action plans, which will include estimated excavation duration, will be available before any remedial action begins. Remedial action on the CS-10/FS-24 Source Area soils is presently expected to commence in the summer of 2000.

November 13, 1998, electronic mail from Sharon and Richard Judge, Sandwich

Comment: When contaminated soil is excavated and taken off-site, it should be done in a coverered area, ensuring that neighboring communities will not be exposed to contaminated air.

November 12, 1998, letter from Paul Zanis, Forestdale

Comment: Soil removal must be done with as little dust generation as possible to protect the public. Doing so means dust suppression upon excavation. Loading of the trucks must be done inside a shrink wrapped building.

Response: The previous two comments can be addressed in one response. The design of the remedial actions will include proper dust suppression at all levels of the activity. However, providing enclosures around the site for the excavation and loading of soils is probably not a viable option because of the size of the site and was not included in the cost analysis performed in the Focused Feasibility Study.

12. Twelve comments from six commentators expressed concern regarding air quality monitoring and health and safety issues during implementation of the asphalt-batching alternative.

Public Hearing statement from Susan Walker, Sandwich

Comment: Assurances should be made to the neighbors that during the excavation and handling of the soils that not only are the workers at the sites protected by intense air quality monitoring, but also the residential areas and the children who are there are also protected by monitoring at the Base boundary. The recommendation is for continuous, 24-hour air monitoring and also a notification plan for the residents should any problems concerning air quality occur at the sites.

Public Hearing statement from Sharon Judge, Sandwich

Comment: The air quality monitoring must be done in the neighborhoods or at the perimeter of the base.

October 7, 1998, letter from Pamela McClung, Sandwich

Comment: Will you provide air monitors on base perimeters with an emergency notification system for residents in case air quality is in jeopardy during the cleanup process of all sources at the UTES?

November 11, 1998, letter from Suzanne Sevco, Forestdale

Comment: Due to my illness I feel any chemicals inhaled could endanger my health. I would like to see air monitors at every site and an emergency notification system for my safety.

Response: The four preceding comments can be addressed in one response.

During the development of the remedial action plans, a Health and Safety Plan will be developed that will include air quality monitoring. The public concerns will be addressed in this plan, and the public will be included in the planning process.

Public Hearing statement from Pamela McClung, Forestdale

Comment: Does the engineering team in charge of this clean up process wear masks during excavation and asphalt batching and any other protective gear and why? Are we at risk for exposure via inhalation at the source during clean up?

Response: During any remedial investigations or actions, all workers wear protective clothing and gear as required in a Health and Safety Plan. In addition, an exclusion area is established into which no one without proper certification of health and safety training and knowledge of the site-specific Health and Safety Plan is allowed. Anyone outside the exclusion area is not under risk of exposure to any contaminants being managed at the site. All necessary controls will be identified and implemented before execution of any excavations or asphalt batching.

Comment: What is the procedure if air quality is in jeopardy during excavation?

Response: The remedial activities will be designed to protect the air quality during excavation. The detailed procedure on response actions to elevated contaminants in the air during excavation will be included in the Health and Safety Plan but will likely include alarms that will alert workers to cease operations until the problem is corrected. The Health and Safety Plan will be submitted for regulatory approval in conjunction with the Remedial Action Plan. Remedial Action on the CS-10/FS-24 Source Area Soils is presently expected to commence in the summer of 2000.

Comment: Are the chemicals listed in Detail E and F considered PAHs? What are PCBs? Are they dangerous via inhalation? What is the distance from source E to Greenway?

Response: The semivolatile organic compounds listed for Details E and F are polycyclic aromatic hydrocarbons (PAHs).

PCBs are polychlorinated biphenyls, which is a class of chemicals characterized by being very stable and once widely used in the electrical industry for transformers and other devices. Exposure to certain levels of PCBs by inhalation could be considered harmful; however, PCBs are not volatile compounds under normal conditions, which means that they are not likely to be present in the form of a gas or vapor that could be inhaled.

From the eastern edge of Detail Area E to Greenway Road is approximately 400 ft.

Comment: I think an alarm would be a good way to notify the neighborhood if there are high levels [of volatiles] in the air.

Response: Because the contaminants of concern are adhered to the soil, there is little risk of volatilization; controls will be implemented to eliminate the risk of air-borne particulates. The remedial plans will address the health and safety concerns. AFCEE will consider using alarms, if warranted.

October 7, 1998, letter from Pamela McClung, Forestdale

Comment: What is TPH? Is this chemical dangerous via inhalation during the excavation process.

Response: Total petroleum hydrocarbons (TPH) are defined as the measurable amount of petroleum-based hydrocarbon in an environmental medium. TPH contamination refers to the presence of crude oil or petroleum products in an environmental media (e.g., soil, sediment, groundwater, air, or surface water). Petroleum is a mixture of hundreds of hydrocarbon compounds. Industry specifications for refined petroleum products, such as gasoline and diesel fuel, are based upon physical and performance-based criteria, not upon a specific chemical formulation. As such, the compositions of petroleum products released to the environment are complex and variable. This variability is a function of (1) the origin and chemistry of the parent crude oil, (2) refining and blending processes, and (3) the use of performance-enhancing additives. After being released to the environment, the chemistry of a petroleum product is further altered by contaminant fate and transport processes, such as leaching, volatilization, and biodegradation.

Although the measurement of TPH provides an overall concentration of petroleum hydrocarbons, TPH measurements alone do not provide a direct indication of the risk posed by petroleum hydrocarbon contamination. Both mobility and toxicity are very dependent upon the relative amounts of individual (or groups of families of) constituents within a hydrocarbon mixture.

Because TPH contamination is composed of a mixture of volatile and semivolatile compounds, exposure can occur not only through direct contact via ingestion and dermal contact but also through inhalation. Exposure to the general public is not expected during excavation. The work site is monitored for protection of worker health, which subsequently ensures protection of the general public by preventing exposures to levels that pose a health risk. Engineering controls, such as wetting the soil during excavation, will also be employed to ensure worker and public safety.

Comment: Is the Pesticide found at source F dangerous via inhalation during the excavation process?

Response: The remedial actions plans will be designed to protect the workers and public from inhalation of the excavated material; therefore, there should be no elevated risks from these activities. In addition, pesticides at Detail F are not present at concentrations that could result in inhalation risks for human receptors in excess of federal (USEPA target risk range of 10^{-4} to 10^{-6} and HI ≥ 1.0) or state (MADEP 10^{-5} risk and HI ≥ 1.0) risk management guidelines for current and future receptors.

Public Hearing statement from Joel Feigenbaum, Plume Management Team, Sandwich

Comment: The Proposed Plan doesn't address at all the methods of protecting the community from the results of the soil excavation. It just says that this is going to happen but there is no outline of the protections and the monitoring that will occur. And that has to be extremely detailed in order for it to be a plan at all. And it's not included in any kind of detail. It's almost as if you didn't care.

Given the amount of specificity that's in here, I certainly wouldn't want to be raising my children in such proximity to where you're going to do the excavation of these dangerous substances.

Response: The Proposed Plan is intended to be a brief, simplified presentation of proposed remedial activities and factors considered during their evaluation, consistent with the CERCLA process. Further details regarding site characteristics and proposed remedial activities are presented in *Record of Decision Areas of Contamination CS-10/FS-24 Source Operable Units.* The actual details for performing the work will be developed in a Work Plan and Health and Safety Plan after the ROD has been approved by AFCEE and USEPA.

November 12, 1998, electronic mail from Paul Zanis, Forestdale

Comment: The air monitoring you propose is incorrect for all your proposed projects and needs a complete overhaul. I posses government research documents done on Cape Cod that must be used to update your air monitoring. Given the opportunity I will share these documents with you.

Response: Specific comments and information on improving our remedial action plans would be welcome. Because the comment period ended, AFCEE would appreciate Mr. Zanis's assistance during the design of the air monitoring program.

13. One commentator expressed concern regarding the covering of contaminated soils during implementation of the asphalt-batching process.

Public Hearing statement from Joel Feigenbaum, Plume Management Team, Sandwich

Comment: The soil handling at FTA-1 was pretty questionable. There were large piles of soil, contaminated soil, that were left exposed to the elements for periods of time. You know, there were even pictures of it in the Cape Cod Times. And that was under AFCEE's watch. So that doesn't lead us to have a great deal of confidence in your soil handling abilities or the care that you take with it.

Response: AFCEE will undertake all necessary actions to ensure the protection of public health and the environment. The Work Plan and design documents will be written to reflect the need for the remediation subcontractor to maintain cover and stockpile surveillance while soils are waiting processing. Also, regulators are likely to inspect operations to ensure proper procedures are followed.

14. Three commentators expressed concern regarding the fate of contaminants after the asphalt batch has been placed into the environment.

November 8, 1998, electronic mail from Joel Feigenbaum, Plume Management Team, Sandwich

Comment: The large area of under-paving will result in enhanced opportunities for volatile substances to enter the environment.

Response: The encapsulation of the soil particles will prevent the volatilization of contaminants.

Comment: Asphalt paving is notoriously unstable--it is subject to cracking and crumbling. The proposed actions will require eternal inspection and maintenance.

Response: Roadways constructed by recycling contaminated soil in the course of the paving system require no more maintenance and inspection than a normal roadway. The stability of a roadway is maintained by preventing deterioration of the soil subgrade. This subgrade soil deterioration is prevented by normal and routine maintenance of the paving system wearing course.

Public Hearing statement from Annie Sullivan, Forestdale

Comment: I understand they (the contaminants) have been adhered to the asphalt or contained somehow, but as they breakdown over the course of the years and I understand that they are underneath the level of other asphalt that's not contaminated, but does that ever breakdown? And if it does, where does it go?

Public Hearing statement from Sharon Judge, Sandwich

Comment: I am not convinced that asphalt batching . . . will guarantee that (contaminants) won't leach into the groundwater or into the air.

September 25, 1998, electronic mail from Sharon Judge, Sandwich

Comment: Exactly what is involved in the asphalt batching process and how can the public be assured that contaminants will not leach into the groundwater or into the air at a later date when the asphalt deteriorates, especially considering our cold winters?

Public Hearing statement from Joel Feigenbaum, Plume Management Team, Sandwich

Comment: I question the huge amount of toxics that will be permanently enshrined in the asphalt at the base. We're not just looking at the first year or five years or 10 years. We're looking permanently and at the cumulative effects of having so much toxic material that is essentially volatile locked up in the asphalt. And as was mentioned earlier, everybody knows that asphalt crumbles and degrades. And at that point it would appear that there would be a possibility that this material would continue to volatilize.

Response: The preceding four comments can be addressed by the following response. Asphalt batching has been shown to be an effective means of remediating contaminants in soil.

Asphalt-batching is an extensively tested and proven remediation technology that reduces the mobility of contaminants by binding them to soil particles with an asphalt emulsion. Contaminated material is turned into an environmentally stable, structurally enhanced paving subgrade material. The subgrade material is capped with 1.5 inches of asphalt wear cover for durability and to limit the infiltration of water. The technology has been applied to soils contaminated with inorganic and organic compounds. An asphalt-batching system has been successfully operated at IR for contaminated soils removed under the Drainage Structure Removal Program (DSRP). The DSRP identified and removed over 17,000 tons of contaminated soil associated with drainage structures at MMR in 1996. The soil was treated at an on-site asphalt-batching facility and used as subgrade material for approximately 4.5 miles of roadways at MMR.

Asphalt-batching site soils will immobilize the contaminants, thus minimizing potential risks from soils. Asphalt batching has been accepted by the regulators as a technology that is successful at immobilizing the types of contaminants detected at the AOCs addressed in the CS-10 and FS-24 Proposed Plan. Pre- and posttreatment samples will be collected and analyzed to confirm the effectiveness of the treatment system. Leaching of contaminants from asphalt-batched soils has been evaluated at other sites (with favorable results) by sampling groundwater wells near stockpiled treated soils and by performing laboratory leaching tests. Coupled with the formation of a relatively impermeable barrier, the chemical and physical fixation of contaminants by asphalt batching is considered to be protective of human health and the environment and effective in minimizing contaminant migration to the groundwater. The finished product will be used locally as subbase material for roadways at MMR.

Contaminant threshold levels developed by MADEP will be used to assess the acceptability of soils for asphalt batching. If contaminant concentrations exceed these criteria, which are summarized in the table at the end of this Responsiveness Summary, the soils will be disposed off-site. For example, based on the listed criteria, soils exceeding the threshold level for PCBs (2 ppm) would be disposed off-site. Specific locations for the use of this material will be determined with the input of the regulatory agencies.

The binding of the soil particles with the asphalt emulsion effectively protects it from leaching in the environment. In addition, the material will be used for subgrade material that will have clean pavement as a cover. Even if the cover cracks, the subgrade material will not leach the bound contaminants to the environment. However, if it does crack, AFCEE will repair it.

15. Twelve comments were received from six commentators concerning the risk to humans during the implementation of the asphalt-batching alternative.

Public Hearing statement from Pamela McClung, Forestdale, and November 13, 1998, electronic mail from Sharon Judge, Sandwich

Comment: Who sets the soil target clean up levels?

Response: AFCEE, in coordination with the regulatory agencies, established the soil target cleanup levels based on risk-based values calculated to be protective of human health and the environment. The calculations were approved by the regulatory agencies.

Public Hearing statement from Sharon Judge, Sandwich

Comment: In the information brochure you talked a lot about reducing risk. I think you need to eliminate risk.

Response: The preferred method of remediating contaminated materials is to avoid moving them off-site if the levels of contamination are conducive to safe treatment on site.

USEPA's preference for remedial action, as indicated in Section 121 of CERCLA, is for actions that permanently reduce the volume, toxicity, or mobility of contaminants and do so through methods that favor on-site treatment. The reason for this preference by USEPA is that on-site treatment minimizes additional risks associated with transporting hazardous waste and prevents the contamination of new sites if improper disposal occurs. On-site treatment represents a risk management strategy that provides optimal risk reduction.

Although everyone would like to totally eliminate risks if possible, the total elimination of risks is not possible because, by their nature, chemicals!even when used and disposed of properly!pose some risk if exposure occurs. Therefore, the goal of environmental remediation is to reduce risks to levels that are expected to result in no adverse health effects to the most chemically sensitive or most exposed individuals in the affected population. The purpose of the risk assessment is to ensure that estimates of risk are based on current toxicological knowledge about what concentrations result in adverse effects and knowledge of population characteristics that identify potentially exposed individuals. At any point in the risk assessment process where risk management decisions about health protectiveness must be made, estimates of risk are always biased toward health protectiveness to provide an added measure of safety to any estimate of risk used to make cleanup decisions.

September 25, 1998, electronic mail from Sharon Judge, Sandwich

Comment: In the Proposed Plan information sheet, AFCEE talks about "reducing" exposure risks. What about "eliminating " exposure risks?

Response: This comment was repeated in a November 13, 1998, electronic mail as one of the reasons why the Proposed Plan is unacceptable and was addressed earlier in this Responsiveness Summary. The Response is repeated here.

Although everyone would like to totally eliminate risks if possible, the total elimination of risks is not possible because, by their nature, chemicals!even when used and disposed of properly!pose some risk if exposure occurs. Therefore, the goal of environmental remediation is to reduce risks to levels that are expected to result in no adverse health effects to the most chemically sensitive or most exposed individuals in the affected population. The purpose of the risk assessment is to ensure that estimates of risk are based on current toxicological knowledge about what concentrations result in adverse effects and knowledge of population characteristics that identify potentially exposed individuals. At any point in the risk assessment process where risk management decisions about health protectiveness must be made, estimates of risk are always biased toward health protectiveness to provide an added measure of safety to any estimate of risk used to make cleanup decisions.

Public Hearing statement from Annie Sullivan, Forestdale

Comment: The words to me “future scenario” and “potential cancer risks” seem. . . vague. It almost implies that there’s no current risk.

Response: In the preliminary risk assessment, an evaluation of current and future land use forms the basis for identifying and evaluating potentially exposed individuals. Current land use refers to the site as it is today. Future land use is defined as any reasonably anticipated future use of the site as defined in USEPA guidance [*Land Use in the CERCLA Remedy Selection Process* (USEPA 1995)]. Future use of the site is determined with input from stakeholders. Using information from the evaluation of current and future land use, a set of exposure scenarios is developed for use in estimating risks. These exposure scenarios are specifically defined in terms of who is exposed, how they are exposed, and what the characteristics of the exposed individual are (e.g., intake rate, exposure frequency, exposure duration, and body weight). The specifically defined exposure scenarios evaluated for CS-10/FS-24 are current worker, current trespasser, potential future worker, potential future trespasser, and potential future resident. In fact, none of the CS-10/FS-24 areas of concern present a current or future health risk. However, areas of concern at CS-10/FS-24 do present potential risks to ecological receptors.

Public Hearing statement from Joel Feigenbaum, Plume Management Team, Sandwich

Comment: There’s also been no comprehensive risk assessment in terms of a full analysis of the possibility of air pollution.

Response: The potential for air pollution has been assessed in two ways. First, the atmospheric exposure pathways have been identified in the risk assessment and incorporated into the dose estimates used to calculate risk. This effort identified volatilization and particulate resuspension as possible mechanisms for atmospheric release from the site. Understanding these potential risks affected the decision to recommend remedial actions designed to minimize the release of contaminants via these pathways during the actual cleanup. Therefore, cold mix asphalt batching was chosen because it minimizes atmospheric releases of volatile compounds and dusts. Based on consideration of potential volatile and particulate releases associated with remediation, active measures to reduce volatilization and particulate emission, such as soil wetting and stockpile covering, will be implemented. In addition, on-site monitoring during remediation provides the necessary safety infrastructure needed to stop work should safe levels be exceeded.

November 8, 1998, electronic mail from Joel Feigenbaum, Plume Management Team, Sandwich

Comment: No comprehensive health risk assessment has been done using site specific weather data on the cumulative impacts of all of the asphalt batching that has been proposed. In particular, no information had been forthcoming on the degree to which the batching process will increase the surface area of volatile organics and other contaminants that will be processed and thus facilitate entrance into the environment.

Response: One of the advantages of asphalt batching is the sealing of the soil particles in the asphalt emulsion, thus eliminating the opportunity for volatilization of contaminants. The process will not increase the surface area of the soil particles.

Comment: The cold batching process uses low molecular weight petroleum products: precisely what are these and what levels of substances like benzene and toluene are found in them both initially and during the evolution of the mixture. A large asphalt production operation, in the midst of the dense residential community of the Upper Cape, is itself a prospect that cannot be viewed as health promoting, even if it did not involve a vast variety of known carcinogenic waste.

Response: The term "low molecular weight" used in reference to the cold batching process is relative to the higher molecular weight in hot mix asphalt. The cold-mix asphalt batching process uses an asphaltic emulsion applied at ambient temperature to encapsulate the contaminated soil and virgin aggregate and thereby produces a roadway paving material. No substances such as benzene or toluene are components of the emulsion used in this process.

September 9, 1998, electronic mail from Richard Hugus, Otis Conversion Project

Comment: Asphalt batching has been proposed as the means of cleaning up contaminated soil at this site. I request an extension of the comment period until adequate information is provided to the public on (1) the risks of human exposure to contaminants dispersed into the environment during the batching process and (2) the fate of contaminants in the environment once they are batched.

October 11, 1998, letter from David Dow, East Falmouth

Comment: The third paragraph of this letter recommends that the risk assessment be redone as well as the need for AFCEE to provide more information on the asphalt batching process and the impacts of asphalt aging over time on the release of contaminants [to the environment].

Response: The two preceding comments can be addressed in one response.

To assess potential risks associated with cold asphalt batching, potential sources of chemical release and potentially exposed individuals must be identified to establish whether completed exposure pathways exist. An exposure pathway is defined as the physical and chemical processes by which a contaminant is transported through the environment from a source of contamination to an individual receptor. Generally, an exposure pathway consists of five elements: a source, transport pathway, exposure point, exposure route, and a receptor. Exposure cannot occur if any one element of a completed exposure pathway is absent or inactive at a site.

Sources of chemical release associated with cold asphalt batching can be identified by examining individual components of the batching process. To manage potential risks from identified exposures, actions are taken to prevent or minimize volatile and particulate releases. These steps are listed below with associated environmental transport pathways indicated in parentheses. The mitigation measures that will reduce or prevent exposure are then described.

1. Excavation of soil (volatilization and particulate resuspension into the air). There is no way to prevent this from occurring during the excavation of the soil. However, as part of the health and safety procedures that will be implemented, an air quality monitoring program will be established. Compliance with health and safety plans and required atmospheric monitoring allows for the activation of safety measures and/or stop work orders if health protective concentration thresholds are exceeded, thus preventing unacceptable exposures to workers and the general public.

2 Transport of off-specification soils to licensed hazardous waste disposal facility (volatilization and particulate resuspension into the air). Off-specification soils are generally stockpiled on-site away from areas where public exposure could occur while they await transport to a licensed hazardous waste disposal facility. In addition, because of the potentially hazardous nature of these soils, a cover is used to limit volatilization and prevent particulate resuspension. Transportation requirements require covering of transported materials to prevent release and subsequent exposure. Due to the low concentrations of soil contaminants, the volume of soil requiring off-site transportation will be limited.

3. Loading of soil into a hopper for conveyance to a mixing chamber (volatilization and particulate resuspension into the air). Physical controls on the loading process as well as soil wetting and/or treatment with antidust agents reduce particulate emission while loading the hopper. Compliance with health and safety plans and required atmospheric monitoring allows for the activation of safety measures and/or stop work orders if health protective concentration thresholds are exceeded, thus preventing unacceptable exposure to workers and the general public.

4. Application of emulsion using rotating blades (off-gassing of volatile emissions into the air). Emulsion solution wets the contaminated material preventing particulate resuspension by coating the soils. This limits exposure via volatilization to all individuals except those involved in the mixing process. Use of asphalt emulsion during the mixing wets and coats the contaminated soil. This physical process limits particulate release and volatile emission eliminating the potential for migration beyond the immediate work area. Compliance with health and safety plans and required atmospheric monitoring allows for the activation of safety measures and/or stop work orders if health-protective concentration thresholds are exceeded, thus preventing unacceptable exposures to workers and the general public.

5. Combining with larger aggregate to complete the stabilization of the asphalt paving material (volatile emissions into the air). Use of additional aggregate controls the amount of

contaminated material per unit of asphalt produced to ensure proper curing and stabilization of the hazardous components.

6. Stockpiling of the paving material for curing (72 hours) (volatile emissions into the air). The curing process binds contaminants to the substrate and prevents volatile and particulate release of hazardous components. Air monitoring at the site is used to verify that this controlled process is effective.

7. Stockpiling for future or immediate use in roadways or parking facilities (cured paving material is not expected to release any hazardous materials beyond normally expected volatilization of hydrocarbons associated with asphalt paving material). During asphalt stockpiling, contaminated soils are bound to the aggregate during curing, thus preventing any release to the environment or exposure to workers or the public. Leachability testing will be conducted to verify that proper curing has occurred before using as the material.

October 11, 1998, letter from David Dow, East Falmouth

Comment: The first paragraph of this letter questions the relationship between the selection of asphalt batching as the preferred alternative and the risk assessment approach used to make the decision. The comment centers on the risk of the actual remediation process.

Response: The methods used to conduct the Preliminary Risk Assessment (PRA) are consistent with guidance provided by USEPA and MADEP for performing human health and ecological baseline risk assessments, which are required under CERCLA during the RI process. The purpose of a baseline risk assessment, and therefore the PRA, is to evaluate risks associated with exposure to site contaminants in the absence of remedial action. That is, the PRA evaluates the No Action remedial alternative and answers the question "What are the risks if we do nothing about the contamination?" Risks estimated in this process address chronic (long-term) exposure potentially occurring for a substantial portion of an individual's lifetime.

Risks associated with remedial actions are also assessed, but not in the PRA process. CERCLA provides for an evaluation of risks associated with remedial action as part of the evaluation of long- and short-term effectiveness. This evaluation is often qualitative (i.e., the risks are identified; however, they are not measured) in nature when a proven technology, such as asphalt batching, is being used. Only when new or untested technologies are used in remediation does a quantitative (i.e., the risks are not only identified, but they also are measured) assessment become necessary. Risks are generally known for proven technologies and are mitigated through standard administrative and engineering controls. These controls are designed to minimize exposure to workers who, by virtue of the activities they perform, are likely to receive the highest dose of any potential receptor during remediation. Because workers are exposed through the same exposure routes (and often additional exposure routes) as other potential receptors (e.g., off-site residents), administrative and engineering efforts to control exposure to workers are considered to be protective of all potential receptors during remediation.

Comment: The second paragraph of this letter discusses potential toxic effects and risk for the congeners of PCBs rather than for a commercial mixture of PCBs (e.g., Aroclors) and concern that these compounds have not been addressed, as well as concerns about degradation products of DDT.

Response: The human health risk assessment process for PCBs is a valid and meaningful process and is conservatively based on the toxicity of congeners found in each Aroclor. Analytical procedures report PCBs as the total concentration of congeners in each Aroclor. There are more than 200 PCB congeners, and the most prevalent Aroclors (i.e., mixtures of congeners) found in environmental media are Aroclor-10 16, Aroclor-1242, Aroclor-1248, Aroclor-1254, and Aroclor-1260. The primary producer of PCBs in the United States manufactured the products under the trade name of Aroclor. Aroclor products were designated by a four-digit number. The first two digits represent the type of molecule; 10 or 12 represents a chlorinated biphenyl. The last two digits represent the percentage of chlorination by weight. For this reason, and because the severity of toxicity tends to increase with the percentage of chlorination (with the 60% chlorination of Aroclor-1260 being among the most highly chlorinated of all mixtures), the majority of toxicological research has focused on these common Aroclors.

Risk assessments quantify cancer and noncancer (systemic) risks using dose-response values published in USEPA's Integrated Risk Information System (IRIS), which is an on-line data base (www.eta.gov/iris/). These dose-response values published in IRIS are peer-reviewed values that are developed to be protective of the most sensitive individuals within the population and for the most sensitive adverse effects associated with exposures to the chemical of interest. Therefore, although a chemical (or group of chemical congeners) may be associated with several adverse effects and/or modes of action, the dose-response values published in IRIS are protective for all of the potential adverse effects associated with the chemical (because the dose-response value is based on the most sensitive of those effects).

Noncancer dose-response values (reference doses, or RfDs), are published in IRIS for Aroclor-1016 and Aroclor-1254. USEPA has determined that there is insufficient information to derive dose-response values for other Aroclor congeners. The RfD for Aroclor-1254 (which is lower and therefore more conservative than the RfD for Aroclor-1016) is used to quantify noncancer risks for all other Aroclor congeners. The RfD for Aroclor-1016 is based on the no observable adverse effects level (NOAEL) for reduced birth weights in monkeys fed diets containing various concentrations of Aroclor-1016. The RfD was derived by adjusting the NOAEL value downward by a 100-fold factor to account for extrapolation of the effects observed in monkeys to human populations. The RfD for Aroclor-1254 is based on the lowest observable adverse effect level (LOAEL) for immunological effects in monkeys fed various concentrations of Aroclor-1254. The RfD was derived by adjusting the LOAEL value downward by a 300-fold factor to account for extrapolation of the effects observed in monkeys to human population.

Cancer dose-response values (cancer slope factors, or CSFs) are published for a PCB mixture composed of the common congeners listed previously. USEPA has determined that the evidence of cancer in humans from possible exposures to PCBs in inadequate. Therefore, the CSF is based on the findings of a significantly increased incidence of liver tumors in rats fed various concentrations of the PCB mixtures. USEPA has determined that these RfDs and CSFs are appropriate for use in public health risk assessment and are protective for the range of possible adverse effects that may be elicited through possible human exposures to PCBs.

DDT is not a contaminant of concern for the sites at CS-10 and FS-24.

16. **Four commentators expressed concern about asbestos and the disposition of the existing buildings.**

November 9, 1998, electronic mail from Richard Hugus, Falmouth

Comment: The BOMARC facility buildings are in a state of complete deterioration. They should be demolished, taking all necessary steps to prevent the exposure of nearby residents to asbestos and other hazardous airborne material.

November 12, 1998, electronic mail from Paul Zanis, Forestdale

Comment: I am taking this opportunity to comment on the proposed cleanup plan of the BOMARC site. First, the removal asbestos from the buildings at the BOMARC sight should be done under surgical conditions. The buildings are so dilapidated that they should be shrink wrapped (like a boat) to keep all the contaminants confined as much as possible from migrating to the neighborhoods in the surrounding area.

November 13, 1998, electronic mail from Sharon and Richard Judge, Sandwich

Comment: When contaminated soil is excavated and taken off-site, it should be done in a covered area, ensuring that neighboring communities will not be exposed to contaminated air. (The comment in this sentence was addressed previously but is included here for context.) The same precaution should be taken for asbestos removal. We have often seen buildings "wrapped" during treatment of infestations. This type of "wrapping" at the very least should be done during these remediation efforts as the buildings are so delapidated and "airy."

Response: The three preceding comments can be addressed by one response.

The Proposed Plan that is under consideration is for the remediation of soils and sediments at CS-10/FS-24 and does not address the buildings or asbestos in the buildings. However, your comments on other issues at the BOMARC site will be considered.

17. **Nine miscellaneous comments and statements were received from seven commentators.**

Public Hearing statement from Daniel Drum, Forestdale

Comment: After the drainage swale that extends from Detail Area F is tested, and assuming no hazardous materials are found in that area, would the military investigate the possibility of releasing the right-of-way back to the ownership and use by the property owners?

Response: A requirement of CERCLA regulations is a periodic review of the remediated site to determine if the site is clean enough to release from further reviews. After the sites have been removed from the CERCLA program, the military may consider releasing the right of way.

Public Hearing statement from Pamela McClung, Forestdale

Comment: Why are all of the clean up alternatives only providing short-term effectiveness as shown on p. 6 of the Proposed Plan?

Response: The table on p.6 of the Proposed Plan summarizes, in general terms, the comparison of the alternatives evaluated against the six evaluation criteria, one of which is short-term effectiveness, as required in the CERCLA Feasibility Study process. All the alternatives, with the exception of the No Action alternative and Limited Action alternative, at least partially meet the other criteria. The chosen alternative, Alternative 3, meets or exceeds all criteria except short-term effectiveness, which is partially met. The short-term effectiveness is listed as "partially meets criteria" because the thermally enhanced SVE will take longer to remediate the site than excavation of the soils (excavation of the deep soils is not a feasible alternative). However, because the soils being remediated by SVE are deep soils, there is no immediate risk to exposure to these soils during remediation.

November 13, 1998, letter from Pamela McClung, Forestdale

Comment: Has the military ever contaminated private residential property similar to the situation presenting itself at the BOMARC site? At any time in the past, has the Military compensated private homeowners financially for their health/financial losses associated with the contamination?

Response: These comments are not pertinent to the Proposed Plan for CS-10/FS-24. However, the Department of Defense does have a Formerly Utilized Defense Sites program under the auspices of which it can assess the likelihood of contamination on sites formerly owned or used by the military. Under this program, DOD can clean these properties if any contamination deemed to present a risk to human health or the environment is found.

Public Hearing statement from Sharon Judge, Sandwich

Comment: At the public meeting in July, we were told that we would have a lot of public information opportunities. There was just one other one prior to tonight. In July I made the comment (to Jan Larkin) that I didn't like the attempt to break up the group. I don't like the fact that a small group of neighbors was invited into the Joint Program Office this week. I think all meetings should be public and in public places with proper notification.

Response: AFCEE has made all information pertaining to this project available to the public and will continue to try to meet the concerns of the public.

Public Hearing statement from Joel Feinenbaum, Plume Management Team, Sandwich

Comment: I had thought that the comments and the discussion that was held at the last JPAC meeting was going to be a part of the official record. And we had discussed that. And it's my understanding that AFCEE agreed to it that there was taping of that and a verbatim transcript is produced. So I would like to request that that be added to the official record. We shouldn't have to be making comments over and over again in different forums all the time.

Response: A transcript of that meeting will be included in the Administrative Record.

Comment: It seems to me like it's really poor planning when you knew you had all these soil removal operations to have gotten rid of the FTA soil treatment plant.

Response: The FTA-1 system was furnished through a contract that addressed the remediation of FTA-1. Other sites had not been characterized or had not completed the Feasibility Study process to determine if this technology was appropriate. The thermal treatment system used at FTA-1 was removed about 1 year ago, and it would have been cost prohibitive to have it remain idle for that length of time while other sites were being studied.

Incineration of soils was included in the initial screening of alternatives in the FFS for CS-10/FS-24 but was eliminated from further consideration because it was difficult to implement, may not be effective for some metals in the soils, and the resultant ash may require additional treatment. If thermal treatment or incineration had been found to be a viable alternative for CS-10/FS-24, it would have been retained in the analysis.

November 9, 1998, electronic mail from Richard Hugus, Falmouth

Comment: The numerous military vehicles and the U.T.E.S. vehicle maintenance shop now operating at site CS-10 have no place in a sensitive watershed area. They should be removed.

Response: An MMR Master Plan is in preparation to address the current and future proposed uses on MMR and will be available for public review in the near future. The Army UTES facility will be evaluated and addressed in that report.

November 9, 1998, Proposed Plan comment from Catherine Paris, Forestdale

Comment: This comment requested a series of groundwater monitoring wells at the eastern end of the culvert area at Snake Pond Road to determine if there is a plume parallel to CS-10.

Response: The Proposed Plan for CS-10/FS-24 addresses the proposed remedial alternative for contaminated soils and sediments only. Groundwater has been addressed under a separate program.

November 11, 1998, letter from Suzanne Sevco, Forestdale

Comment: Please notify me prior to testing and clean-up of any area at the BOMARC Site!

Response: MMR will continue to keep the public notified of the activities that are planned.

WRITTEN COMMENTS RECEIVED DURING PUBLIC COMMENT PERIOD

From: Richard Hugus [rhugus@cape.com]
Sent: Wednesday, September 09, 1998 10:22 PM
To: doug.karson@mmr.brooks.af.mil
Cc: manchessault.paul@epamail.epa.gov
Subject Comment on CS-10

September 9, 1998

Richard Hugus
5 Amvets Ave.
Falmouth, MA 02540
rhugus@cape.com

Headquarters
Air Force Center For Environmental Excellence
Attn.: LF-1
322 E. Inner Road
Otis ANGB, MA 02542-5028
doug.karson@mmr.brooks.af.mil

Mike Jasinski
U.S. EPA
J.F.K. Federal Building
Boston, MA 02203
jasinski.mike@epamail.epa.gov

Comments on Proposed Response for CS-10, Massachusetts Military Reservation:

Asphaft batching has been proposed as the means of cleaning up contaminated soil at this site. I request an extension of the comment period until adequate information is provided to the public on 1) the risks of human exposure to contaminants dispersed into the environment during the batching process and 2) the fate of contaminants in the environment once they are batched.

Richard Hugus
Otis Conversion Project

From: Richard Judge [SMTP:judges@capecod.net]
Sent: Friday, September 25, 1998 9:22 AM
To: doug.karson@mmr.brooks.af.mil
Cc: jasinski.mike@epamail.epa.gov
Subject: CS-10/FS-24

September 25, 1998

Doug Karson
HQ AFCEE/MMR
Attn: CS-10/FS-24 PP
322 E. Inner Road
Otis ANG Base, MA 02542-5028

PRELIMINARY COMMENTS ON PROPOSED PLAN FOR CS-10/FS-24

I am writing today to request an extension of the public comment period for the proposed cleanup plan for CS-10/FS-24. The public needs more "public information meetings" in order to have enough knowledge of this complicated source site to be able to adequately comment on the proposed cleanup plan.

The public meeting last Thursday, Sept. 10th was not attended by any members of the public. Notification of the abutting neighborhoods was tardy. Notification via the news media was also inadequate given the enormity and complexity of this site.

As a result, concerned residents attended a meeting at the Joint Program Office last evening. Lt. Col. Barbara Larcom and Jan Larkin hosted the meeting. It was strange to me however that only one concerned resident got an invitation to this meeting. This resident in turn notified her neighborhood as well as some officials in the hopes of getting numerous questions answered.

Though Jan and Barbara were cordial, they could not answer any of the technical questions posed by the residents, only questions regarding MMR control issues and historical issues regarding the source site. Marty Aker of AFCEE was able to lend some assistance in answering a few questions but not all of them. It was clear from the meeting that more public information meetings are necessary so that residents have the opportunity to get all of their technical questions answered in order to be able to adequately comment at future public hearings.

The public needs more information on "asphalt batching." Exactly what is involved in the process and how can the public be assured that contaminants will not leach into the groundwater or into the air at a later date when the asphalt deteriorates, especially considering our cold winters?

Who set the STCL levels?

In the Proposed Plan information sheet, AFCEE talks about "reducing" exposure risks. What about "eliminating" exposure risks?
More information is needed regarding SVE.

More in depth information is needed regarding the alternatives not preferred by AFCEE. Given the fact that MMR is home to one of the worst EPA Superfund sites, the contaminated soils should be taken off-site, off Cape Cod.

Most disturbing to me is the lack of information regarding radiologicals. Marty Aker explained that Oakridge is not done with their testing yet. The public comment period should not have begun until this testing was completed. The public needs more information on the method of testing as well as the extent of testing for radiologicals. The public would like more information as to why the water is not being tested for radiologicals.

Why has soil and water testing stopped at the MMR fence? This site is the closest to residential neighborhoods outside of MMR than any other.

These are just a few of my preliminary questions. Extend the public comment period and hold some more public information meetings. This site commands this response.

Sincerely,

Sharon Judge
P.O. Box 150
Sandwich, MA 02563

ADDITIONAL **QUESTIONS** FAXED **TO** AFCEE

1) When an area is tested for chemicals and reads positive, how far down and out do you continue -to go until you get a negative read?

2) Does more testing need to be done under the water at Source F? Is one toot deep enough?

3) Could you provide documentation that the Town of Sandwich was notified of the chemical contamination found at the nine source areas at the UTES on MMR?

4) Do you know the highest recorded level of water at East Pond?

5) After these nine source area are considered clean are there any more areas at the UTES that need testing and cleaned up? If so, how many?

6) What is TPH? Is this chemical dangerous via inhalation during excavation?

7) Why doesn't the drainage structure that comes from East Pond under Greenway into my backyard appear on the Source F map an page thirteen?

8) Is the Pesticide found in source F dangerous via inhalation during the excavation process?

9) How long will you be excavating at each source area, particularly Source E and F?

10) Will you provide air monitors on base perimeters with an emergency notification system for residents in case the air quality is in jeopardy during the clean up process of all sources at the UTES ?

11) I would like to formally request an extension of the comment period concerning this Proposed Cleanup Plan due to the unresolved Issues surrounding this matter.

To: Doug Karson, AFCEE
From: Pam McClung (508) 477-5922
Date: 10/7/98
Pages: 1

Doug,
Additional Questions regarding the Proposed Plan (CS-10/FS-24)

David Dow
18 Treetop Lane
East Falmouth, Ma. 02536-4814
October 11, 1998
508-540-7142 (e)

HQ AFCEE/MMR
Attn: AOC CS-1 0
322 East Inner Road
Otis ANG Base, Ma. 02542-5028

Dear Sir/Madam:

I am commenting on the proposal for cleanup of the source area of contamination for CS- 1 0, with asphalt batching being the preferred alternative for this area of contamination (AOC). Since asphalt batching is the alternative of choice for a number of AOCs at the Massachusetts Military Reservation (MMR) and this procedure will involve removal of the contaminated soil with treatment at a central location over a period of a couple of years, a more holistic approach needs to be taken in the risk assessment process which is used to justify this procedure as the generic preferred alternative. Obviously when one removes the soil and transports it to a central site for treatment, it increases the chance for atmospheric transport of contaminants to workers and neighbors in adjacent off site communities. The current risk assessment based upon the in ground contaminant exposure to potential human and ecological receptors therefore does not seem very relevant to the situation that we are actually facing. Also since the contaminant list includes heavy metals (As, Pb), polychlorinated biphenyls (PCBs),BTEX's (benzene, toluene, ethyl benzene, and xylene), chlorinated pesticides, etc. in the soil, catch basins, and former drainage structures , we are faced with a complex mixture of contaminants the risk for which needs to be assessed in a cumulative fashion, with consideration being given to the chemical form in which these contaminants actually reside in the soil. For example, organometallic complexes of heavy metals such as arsenic and lead have much greater bioavailability than do their inorganic contaminant forms. One would hope that the Air Force Center for Environmental Excellence (AFCEE) would have chosen a treatment method which actually reduced the toxicity, mobility, or volume of contaminants through treatment, rather than simply isolating these contaminants in asphalt for an indeterminate period. Volatilization or oxidation of the asphalt over time will increase the availability of the volatile organic carbon (VOC) and semivolatile organic (SVOC) contaminants, so that a leaching test on fresh asphalt initially will likely produce lower potential contaminant exposure than one done 5-1 0 years later after aging has taken place.

The second issue in regards to risk assessment is that PCBs are a complex mixture of congeners that vary greatly in their toxic effect and potential bioavailability. The mode of toxic action depends upon the location of the chlorine attachment on the 6 member carbon ring and the number of attached chlorine atoms to the biphenyl molecule core, with heavily chlorinated congeners with the coplanar chlorine attachment configuration being potential carcinogens, while the more lightly chlorinated congeners being neurotoxic and potential endocrine disrupters. As such treating PCBs as Arochlor 1254 equivalents is essentially meaningless, since this is an industrial formulation of a complex array of congeners that vary greatly in their toxicity and mode of toxic action. One needs to measure the levels of individual congeners that actually exist in the sludge beds and sludge disposal sites and assess the potential toxicity based upon this data. For example the coplanar congeners (37, 77, 81, 105, 114, 118, 123, 126, 156, 157, 167, and 189) are the ones thought to be most likely to cause cancer in humans. The ortho-substituted, nonplanar congeners (22, 52, 101, 138, 153, and 180) are the most likely cause of neurotoxic and potential endocrine disruption effects in humans (which because of their lipid solubility and limited degradation in the environment are found at the highest concentrations in human breast milk). For the chlorinated pesticides the degradation products of DDT (DDD and DDE) can cause greater egg shell thinning in birds than does the parent compound, so that potential impacts on these ecological receptors needs to consider this differential toxicity.

Given the problems in the risk assessment process described in the previous two paragraphs, AFCEE needs to redo the risk assessment to incorporate these factors, so that we get a truer picture of the inherent dangers accompanying the cold asphalt batching process that is proposed as the preferred alternative. Also we need to be provided more information on the asphalt batching process itself and the impacts of asphalt aging overtime on the release of contaminants (even if it is used a road grading base which will be covered by a top layer that will erode over time due to our harsh seasonal temperature changes and heavy vehicle usage). It is very difficult to comment on this proposal intelligently, since the limited information provided to the public leads to many unknowns and uncertainties regarding the long range effectiveness of the actual treatment process. I feel that a precautionary approach should be adopted in which it is incumbent upon AFCEE to show that their preferred alternative is the way to go forward, and not the responsibility of citizen activists to provide a viable alternative. I don't think that asphalt batching has met this test and that the revised risk assessment should lead the way to considering alternative methods for addressing this problem. It is important to cleanup the source areas with a treatment method that actually reduces the levels of contaminants and not simply remove them from human contact for an indeterminate period. My guess is that this will require a multi path treatment approach which will solve this problem in a more holistic fashion. I lack technical expertise in this area, so that I will have to leave it up to the Environmental Protection Agency (EPA'], Massachusetts Department of Environmental Protection (DEP), and AFCEE to develop the appropriate multi train treatment approach.

Additional issues that need to be addressed for the CS- 1 0 Source Area include:

Potential down gradient ethylene dibromide (EDB) pollution associated with the BTEX contaminants (since EDB does not apparently biodegrade extensively at the MMR under the anaerobic conditions in the subsurface that accompany BTEX biodegradation and not all the BTEX has been degraded at CS- 10)

* Area F Culvert needs to be examined off base in the swale area that exists between two neighborhoods in Sandwich that are adjacent to the MMR (since the drainage basins and catchment areas at this site seem to have high levels of a variety of contaminants)

* Need an explanation for the non-detects for fuming nitric acid and hydrazine, since they were extensively utilized at the BOMARC site

Need to have sampling for explosive compounds (RDX, HMX, TNT, DNT, etc.) conducted at this site

Thanks for the opportunity to comment on this proposal.

Yours truly,

David Dow
Treasurer, Cape Cod Group-Sierra Club

> From: joelf@cape.com [SMTP:joelf@cape.com]
> Sent: Sunday, November 08, 1998 8:47 PM
> To: doug.karson@mmr.brooks.af.mil;
jasinski.mike@epamail.epa.gov
> Subject: Comments on CS-16/17 and CS-10
>
> Please accept the following as comments on both the CS-16/17 and CS-10 Removal Actions.
>
1. No comprehensive health risk assessment has been done using site specific weather data on the cumulative impacts of all of the asphalt batching that has been proposed. In particular, no information had been forthcoming on the degree to which the batching process will increase the surface area of volatitle organics and other contaminants which will be processed and thus facilitate entrance into the environment.
>
2. The cold bactching process uses low molecular weight petroeum products: precisely what are these and what levels of substances like benzene and toluene are found in them both initially and during the evolution of the mixture. A large asphalt production operation, in the midst of the dense residential community of the Upper Cape, is itself a prospect that cannot be viewed as health promoting, even if it did not invoplve a vast variety of known carcinogenic waste.
>
3. The large area of under-paving will result in enhanced oppportunities for volatile substances to enterf the environment.
>
4. Asphalt paving is notoriously unstable--it is subject to cracking and crumbling. The proposed actions will require eternal inspection and maintenance.
>
5. The people of the Upper Cape have been subject to a wide range of environmental insults from Otis/Edwards/MMR for nearly 50 years. It is time that toxic substances be entirely removed from our air, water and soil--not redispersed. The proposed action does not meet the ctiterion public acceptability,
>
6. It is admitted that many of the soils are carry concentrations of toxics incompatible with asphalt treatment. Thus large amounts of soil will need to be trnasported to a dedicated dtreatment facility,
hopefully far from human habitation. Since this operation will be carried out anyway, the alternative of transporting all of the soil in this fashion should be feasible.
>
> Thank you for receiving these comments.
>
> Joel Feigenbaum
>
> Joel Feigenbaum
> ph: (508) 833-0144
> 24 Pond View Drive
> E. Sandwich MA 0253

> From: Richard Hugus [SMTP:rhugus@cape.com)
> Sent: Monday, November 09, 1998 10:10 AM
> To: vmusgrave@mmr.brooks.af.mil; doug.karson@mmr.brooks.af.mil
> Subject:

% November 8, 1998
% Richard Hugus
5 Amvets Ave.
> Falmouth, MA 02540
>
> HQ AFCEE
> 322 E. Inner Rd.
> Otis ANG Base, MA 02542-5028
>
> Comment on Proposed Plan for CS-10 and FS-24:
>
> On-site asphalt batching has been chosen as the remediation method for contaminated soil at these sites. Asphalt batching is no more than a process of reducing the concentration of contaminants by distributing them into a wider environment. This is not a cleanup. The proposed plan is unacceptable.
>
> Six years of requests by this commenter and others for declassification of BOMARC operational records have proven fruitless. These records have been classified because nuclear warheads were deployed in the BOMARC facility's 50-some missiles. Incredibly,the Air Force, which operated the facility, claims to be unable to gain access to the BOMARC records. Pertinent information may be contained in these records about the handling and disposal of such hazardous substances as hypergolic and solid rocket fuels, jet fuels, cleaning solvents, munitions, and radioactive material. Without this information the public is unable to judge the adequacy of site and remedial investigations. The Record of Decision on CS-10 should be withheld until these records are produced, with fines under the Federal Facilities Agreement should the deadline for the Record of Decision be missed.
>
> The numerous military vehicles and the U.T.E.S. vehicle maintenance shop now operating at site CS-10 have no place in a sensitive watershed area. They should be removed. Ther BOMARC facility buildings are in a state of complete deterioration. They should be demolished, taking all necessary steps to prevent the exposure of nearby residents to asbestos and other hazardous airborne material.
>
> Richard Hugus
> Otis Conversion Project

HQ. AFCEE/MMR
ATTN: CS-10/FS-24
322 E. Inner Road
Otis ANG Base 02542-5028

11/09/98

Re; Comments On The $1.43 Million Cleanup Plan:

Attention: Mr. Doug Karson,

Dear Sir:

After reading the article regarding the cleanup of the Bomarc Missile Site plus the work your organization has done to clean up the entire pollution problem of the base, I want to say "THANKS" and "CONGRATULATIONS" for doing such an outstanding job under extreme adverse conditions.

You and your staff have done a great deal of hard work trying to satisfy so many environmental activist especially when they did not to their homework when they purchased their homes close to the military installation.

Many of my friends in the UpperCape Area who have been identified as the “SILENT MAJORITY” think that progress is being made on the entire pollution/contamination problem and you should be commended on the difficult task that you face each and every day.

Thanks again in advance to you and your staff and your efforts in this matter are truly appreciated.

Very truly yours,

Walter J. Jaworski

Walter J. Jaworski
7 Portside Dr. P.O. Box-54
Pocasset, MA 02559

c/c P/File

MMR MASSACHUSETTS MILITARY RESERVATION

Installation Restoration Program

Comments on CS-10/FS-24 Proposed Plan

Please use this form to submit your comments during this comment period.
Please use the back if necessary.

After viewing the Eastern Storm Sewer Drainage Impoundment and culvert, I request a series of groundwater monitoring wells heading south from the eastern end of the culvert area (both sides of Snake Pond Rd. I fear that during periods of high water documented by photographs taken since '40s (over)

Name CATHERINE E. PARIS Date 11/9/98

Address 14 KNOLLTOP RD., FORESTDALE, MA 02644

Please mail this form to: Vanessa Musgrave, Community Involvement Manager
HQ AFCEE/MMR, 322 E. Inner Road, Otis ANGB, MA 02542-5028
e-mail: vmusgrave@mafmh.ang.af.mil phone: 508-968-4678 x
fax: 508-968-4673

NOV 1998

CC: DEP S.E. Office
Lakeville, MA

CC: Tom Cambareri
Cape Cod Commission

the culvert would drain high concentrations of floating contaminants out its east end. This possibly could produce a parrell plume to CS 10 containing roughly the same chemicals. The ground water flow, I believe, would take this plume south toward the Farmview Dev. and the J well. Both have had hits. I postulate a plume marked by "pulses" due to the level of the "pond" fluccuating. Weeks Pond monitoring seems out of the potential area. Catherine Paris 11/9/98

Questions: The Bomarc Missile Site

1. In a photo of the Bomarc Site in 1966 shows my land and trees have been removed. I would like my land tested for munitions and any chemicals.

2. Due to my illness I feel any chemicals inhaled could endanger my health. I would like to see air monitors at every site and an emergency notification system for my safety.

3. Is all the testing complete for any additional chemicals that may have been at Bomarc in the past?

4. Please notify me prior to testing and clean-up of any area at the Bomarc Site!

Suzanne J. Sivco
19 Belmont Ave
Forestdale, MA 02644

November 11, 1998

> From: ZAP59@aol.com [SMTP:ZAP59@aol.com]
> Sent: Thursday, November 12, 1998 10:15 PM
> To: doug.karson@mmr.brooks.af.mil; leonard.Pinaud@state.ma.us;
> hunter.johanna@epamail.epa.gov; jasinski.mike@epamail.epa.gov;
> donald.muldoon@state.ma.us; borci.todd@epamail.epa.gov;
> marchessault.paul@epamail.epa.gov
> Cc: rhugus@cape.cam; ddow@whsunl.wh.whoi.edu; joelf@cape.com;
> Judges@capecod.net; pschles@whrc.org;
william.delahunt@mail.house.gov
> Subject: comments CS-10/FS-28 CS-16/CS-17
>>
> November 12,1998
> HQ AFCEE/MMR
> Attn:CS-10/FS24
> 322 E.Inner rd.
> Otis ANG Base
> 02542-5028
>
> Attention comments CS-10/FS-28   CS-16/CS-17
% Doug Karson, Marty Aker, James Snyder, AFCEE/IRP
%
I am taking this opportunity to comment on the proposed cleanup plan of the BOMARC sight. First the removal of asbestos from the buildings at the BOMARC sight should be done under surgical conditions. The buildings are so dilapidated that they should be shrink wrapped (like a boat) to keep all the contaminates confined as much as possible from migrating to the neighborhoods in the surrounding area. The air monitoring you propose is incorrect for all your proposed projects and needs a complete overhaul. I posses government research documents done on Cape Cod that must be used to update your air monitoring. Given the opportunity I will share these documents with you. Soil removal must be done with as little dust generation as possible to protect the public. Doing so means dust suppression upon excavation. Loading of the trucks must be done inside the shrink wrapped building. CS-16/CS-17 must be done in a tent. All contaminated soil must be removed off Cape to an approved sight. This of course this means cold asphalt batching is out for several common sense reasons. First, cold asphalt batching doesn’t mix well. Dry clumps and poor encapsulating is common with this process. Second, have you ever seen cold patching of potholes? It doesn’t last it crumbles and its just a temporary fix. Three, dispersing of contaminants is not a cleanup. Four, to much time will be spent storing contaminated soils with the proven result that it will not be properly handled. AFCEE and its personal has the moral obligation to protect the citizens of Cape Cod no mater what the cost. AFCEE’s remedy does not minimize the risk to human health. Its the cheap way out. Please reconsider.>

Paul Zanis
26 Cove rd.
Forestdale MA. 02644-1907

> From: Richard Judge [SMTP:judges@capecod.net]
> Sent: Friday, November 13, 1998 1:44 AM
> To: doug.karson@mmr.brooks.af.mil
> Cc: jasinski.mike@epamail.epa.gov; johanna@epamail.epa.gov;
> leanard.pinaud@state.ma.us; Ellie.Grillo@state.ma.us
> Subject: Comments CS-10/FS-24
>
> November 13, 1998
>
> HQ AFCEE/MMR
> 322 E. Inner Road
> Otis ANG Base
> 02542-5028
>
> Dear Mr. Karson:
>
> We wish to submit the following comments for the public record. BOMARC is one of the largest if not THE largest source site on MMR. It is also one of the most complex sites and the closest to off-base residences than any other contaminated site on MMR. For these reasons we feel that the most advanced protective steps available must be taken to ensure the safety of the abutting neighborhoods. We feel that all contaminated soil should be taken off-site and off-Cape. As we noted in our comments regarding CS-16/CS-17, cold-mix asphalt batching is unacceptable for several reasons. 1. Due to the enormity and complexity of this Superfund site, we must "eliminate" risk whenever possible vs. just "minimizing" risk to the surrounding communities, especially given our high rates of disease here. 2. Large amounts of soil are expected to exceed acceptable standards for asphalt batching resulting in a great deal of soil will be taken off-site anyway. 3. The process of asphalt batching contaminated soil requires an extensive and tedious process to determine the correct percentage of emulsion. 4. On-site asphalt batching would encourage unnecessary paving on MMR. 5. Asphalt batched underpaving deteriorates more quickly than normal asphalt. 6. There has not been an adequate assessment of the risks of human exposure during the entire process of asphalt batching, from excavation to end product, as well as the risk of exposure to contaminants in the environment when the asphalt batched pavement deteriorates. When contaminated soil is excavated and taken off-site, it should be done in a coverered area, ensuring that neighboring communities will not be exposed to contaminated air. The same precaution should be taken for asbestos removal. We have often seen buildings "wrapped" during treatment of infestations. This type of "wrapping" at the very least should be done during these remediation efforts as the buildings are so delapidated and "airy." More information is needed on the handling practices.of the Bomarc Missiles to properly comment on remediation efforts. Since we do not have adequate records, we must take extraordinary precautions in testing the silos and vicinity for radiologicals, rocket fuel and associated chemicals, etc. For instance we noticed the utilidors on our bus tour of the site last weekend. It appeared the pipes led to each silo. When asked, Marty Aker said sampling in the past showed “some detections” but did not offer more information and said AFCEE would sample these utilidors in the next few weeks. We would like to know specifically which chemicals AFCEE will be testing for and we urge that the utilidors be tested for radiologicals. We were shocked

to learn that contaminated water has been sitting in the basement of some of these buildings for over 10 years! Even more shocking is that it has never been tested! The sumps must be tested as soon as possible. We are not satisfied that there has been adequate emphasis placed on the testing of water and soils for radiologicals. At the initial informational meeting on the BOMARC site this summer at the Forestdale school, the representative from Oakridge Labs demonstrated the detection equipment used to test for radiologicals. More technologically advanced equipment is needed to test the BOMARC site for radiologicals! In our opinion, this site has been "glossed over." Given the enormity and complexity of the site, we feel that ongoing public involvement is critical to a safe and thorough remediation process. All residences in the vicinity should have their property tested for contamination. There must be further investigation into past uses of the areas around the BOMARC site ncluding the residential areas as several neighbors have reported finding shells, antique medicine bottles, etc. in their yards.

Thank you for the opportunity to comment.
>
> Sincerely,
> Sharon and Richard Judge
>
>

11/13/98

To: Doug Karson

From: Pam McClung

Re: Questions Regarding Proposed Plan to Clean up OS10/FS-74

1) I would like to be notified immediately concerning the soil test results taken from the drainage easement flowing from the BOMARC Missile site onto my property. (In writing)

In Addition:

A) I would like test results including chemical concentrations in writing from the independent laboratory conducting the test

B) If contaminants are discovered in the above mentioned drainage structure: What is the proposed cleanup method? Is this part of the larger cleanup effort?

11/13/98

CS10 / FS 24 Questions, Pam McClung (cont'd)

2) Has the military ever contaminated private residential property similar to the situation presenting itself at the BOMARC site? At any time in the past, has the Military compensated private homeowners financially for their health / financial losses associated with this contamination?

3) I feel that additional testing needs to be completed at the CS10 / FS24 sites at deeper depths than already completed (depths greater than 1 foot)

Sincerely,

Pamela McClung

(508) 477-5922

18 Pebble Path
Forestdale, MA 02644

APPENDIX D – TRANSCRIPT OF PUBLIC HEARING

Intentional Blank Page

-------------------------------- X
:
In Re: Proposed Plan for :
CS-10/FS-24 Clean up :
:
-------------------------------- X

Sandwich Public Library
Sandwich, MA 02653
Thursday, October 1, 1998
7:45 p.m.

MARY E. PHILLIPS
Registered Professional Reporter
P.O. Box 160
Sagamore Beach, MA 02562-0160
(508) 888-6717

A T T E N D E E S

Douglas Karson	AFCEE/MMR
Marty Aker	AFCEE/MMR
Elaine Davis	Rep. Tom Cahir
Scott Mitchell	APCC
Richard Burroughs	HAZWRAP
Ellie Grillo	DEP
Todd Borci	EPA
Henry Cui	DEP
Teresa Stephens	Radian
Pamela McClung	18 Pebble Path, Sandwich
Judith & John Clancy	8 Jasper Lane
Sharon Judge	P.O. Box 150, Sandwich
John & Cindy Payne	4 Jasper Lane
Mike Minior	AFCEE
Jan Larkin	JPO
Kent Gonser	JPO
David B. Mason	Sandwich Board of Health
Len Pinaud	MA DEP
Deborah White	18 Belmont Avenue
Pat Gari	14 Belmont Avenue, Forestdale
Kellie Davenport	12 Belmont Avenue, Forestdale
Victoria Paulding	Belmont Avenue, Forestdale
David & Joanne Roderick	14 Pebble Path, Forestdale
Tess Rottero	HAZWRAP

A T T E N D E E S

Sue Walker	197 Farmersville Road, SANDWICH
Doug Halford	Oakridge Nat'l Labs/GrandJunction
Annie Sullivan	13 Pebble Path, Forestdale
Amy Lifkind	CH2M HILL
Jane Moran	OPTECH
Sarah Corner	OPTECH
Joel Feigenbaum	Sandwich
Daniel Drum	Sandwich

P R O C E E D I N G S

(Thursday, October 1, 1998, 7:45 p.m.)

MR. KARSON: We're now going to begin the public hearing portion of tonight's meeting. Hello. Could I have your attention please. If everyone could grab a seat, we're going to start the hearing. Thank you very much.

We're here at this point during the meeting to conduct a formal public hearing at which we will accept oral testimony from those who wish to give it here tonight.

You may also submit written comments to me any time the remaining time that we are here in this building. You can also submit your comments up until the 14th of October.

Any oral comments that you give tonight will be transcribed verbatim. We have a court reporter here. And those comments will become part of the official record in the Responsiveness Summary. And that's a document that will be attached to the Record of Decision that will be issued at a later date as Mr. Aker mentioned when he went over the schedule. And in that Responsiveness Summary all your comments will be listed as well as responses to those comments.

Tonight's hearing is different than the informational meeting that we just conducted. This hearing is exclusively for listening to and recording your comments. We will not be responding to your comments during this hearing.

We may ask you for clarification, if we don't understand your comment or concern. Everyone wanting to comment must speak into the microphone. And when you do, please state your name and residence, town of residence.

And the floor is now open for comment on the proposed plan for the chemical spill 10 fuel spill 24 proposed plan. Who will be first?

MS. LARKIN: Could you remind them please that any comments that are made earlier are not part of the record.

MR. KARSON: Exactly. All the comments and discussion that we had earlier will not be included in the Responsiveness Summary.

So if you wish to have those included formally as part of the record, you need to restate those concerns to restate those questions or submit them at a later date up until the 14th of October to us. So who will be first? Anyone wish to give oral testimony?

MR. KARSON: Susan Walker.

MS. SUSAN WALKER: Susan Walker, Farmersville Road, Sandwich.

You mentioned intense air quality monitoring. I would like to make sure that it is intense. We not only have to worry about the workers who are dealing with these soils, but we also have to worry about the residential area and the children who are there. And I would like to see air monitoring along the base boundary, and for that to be continuous, 24 hours a day during the entire contamination clean up area.

And I think we need some kind of a plan in place to notify the neighbors if there has to be any shut down. So even if there is no problem at the base boundary, I think the neighbors deserve to be notified if for some reason the work has to stop due to air monitoring.

You talked about that you will be, researching how present residential land was used in the past.

But you don't know right now how that residential land was used 20, 30, 40 years ago. And you can't be sure that your research is going to bring up all the answers, because it's a long time ago.

Therefore you should test the yards of that neighborhood because you cannot be completely sure about your research and you should go door to door in the neighborhood and ask them if they want their soil tested.

And as far as TEAC goes, the Technical Environmental Advisory Council, it is my memory back in '92 and '93 that TEAC was closed, that the public was not allowed in there except for designated citizens. And now this comes back to haunt the military. Because People want full disclosure and they have a right for the full free flow of information.

And it was wrong to have TEAC closed. And it is correct now to hold these kinds of hearings and have the kind of citizen action teams that you have. Thank you very much.

MR. KARSON: Thank you. Is there anyone else that wishes to give oral testimony tonight on the proposed plan? Yes, sir.

MR. DRUM: My name is Daniel Drum. I reside at 5 Blackthorn Path in Forestdale. My property abuts the drainage swale which extends from the detail area F of the cleanup area that we're talking about.

I would like to propose that once the soil testing is complete in that drainage swale and assuming that there is no hazardous materials found in that area that the military investigate the possibility of releasing the right of way that they currently have on that drainage swale, in releasing that property back to the full ownership and use of the property owners. Thank you.

MR. KARSON: Thank you. Further comments on the proposed plan?

MR. BORCI: Todd Borci EPA region wide. EPA feels it's necessary to make a couple comments on the record concerning the use of asphalt batching especially at CS-10.

We've taken a look at what the State allowable levels are. And we have pointed out to the Air Force that in several areas at CS-10 existing data indicates that a lot of the soil will not be able to be asphalt batched.

The sampling plans will have to be submitted. And EPA will look at those very closely to make sure that things are done correctly and that the levels in the soils that are asphalt batched are below State requirements. Thank you.

MR. KARSON: Thank you. Further comments on the proposed plan?

MS. PAM McCLUNG: Can I take this to my seat?

MR. KARSON: Yes, you may.

MS. PAM McCLUNG: Pam McClung, Pebble Path Forestdale.

I'm going to go through the questions not expecting answers.

Was the drainage structure that comes from source F under Greenway into the easement on my property at 18 Pebble Path removed, cleaned or filled during the DSRP in 1996? Why was that not done?

Was the soil in this easement tested for chemicals found in source F? Why not? And when will this testing be done?

Will you test my children's play area where ammunition was found and when?

After testing these areas clean, will you provide documentation from AFCEE stating that these areas are clean for all areas tested?

Was the land where Pebble Path and Belmont ever owned, occupied by the military and what was the use?

On Page 4 of the proposed plan it reads

1992 and 1993 a final RI was performed to further characterize contamination and evaluate potential risk. Nine source areas were identified that warrant clean up. These source areas were close to a residential home, mine, and land in the process of being developed.

At any time did you notify the town of Sandwich of the proximity of these source areas?

I find it unacceptable as a neighbor to know of this, 150 feet from my home in 1992 and you did not come knock on my door to notify me, especially when the drainage structure was open and you could enter the pond with children in this neighborhood having full access to a contaminated site.

Does the engineering team in charge of this clean up process wear masks during excavation and asphalt batching and any other protective gear and why?

Are we at risk for exposure via inhalation at the source during clean up?

How far down underneath the water was testing done on sources E and F?

Who sets the soil target clean up levels?

Does the asphalt mixing put chemicals into the air and does this have to be done on site?

Are the chemicals listed in detail E and F considered PAH's? What are PCB's?

Are they dangerous via inhalation? What is the distance from source E to Greenway?

Why are all of the clean up alternatives only providing short-term effectiveness as shown on Page 6 of the proposed plan?

What is the procedure if air quality is in jeopardy during excavation?

On detail F when excavating the 50-foot area that shows six different sites with contaminated soil, each site having several chemicals, is there any special removal process?

I think an alarm would be a good way to notify the neighborhood if there are high levels in the air.

MR. KARSON: Thank you for your comments. Is there anyone else here tonight? Yes, ma'am.

MS. SHARON JUDGE: Sharon Judge, Sandwich resident. My first comment is the process how this site -- we first had a public meeting in July and we were told we would have a lot of public information opportunities. There was just one other one prior to tonight. And tonight wasn't meant to be a public information meeting.

In July I made the comment to Jan Larkin that I didn't like your attempt to break up the group. I know you said it was a way so people wouldn't be intimidated, but I feel that it was potentially a way to diffuse us.

I don't like the fact that a small group of neighbors was invited into the Joint Program Office this past week.

I just happened to hear about it from a friend. Again, I think that was an effort to diffuse and appease potentially so that -- I'll leave it at that. I think all meetings should be public in public places with proper notification.

I would like to make a request right now that the public comment period be extended. You need to -- given the enormity and complexity of this site.

I believe it is the worse site on MMR. Given the enormity and complexity, I think you should not only have several more public information meetings like you did with LF-1, but break them up a little bit. Because it was overwhelming to lump them all together.

I believe that you should move contaminated materials off site and off the Cape. In the information brochure you talked a lot about reducing risk. I think you need to eliminate risk.

I'm concerned about -- a lot about the asphalt batching. A neighbor at the Joint Program Office meeting mentioned that Turpentine Road is washing away. And I understand that was -- that asphalt was the product of asphalt batching. And I'm not convinced yet. Maybe I just need more time that the contaminants won't -- I don't feel I have been guaranteed that they won't leach into the ground water or into the air.

I think there's been -- to date there's been inadequate testing of soil and water for radiologicals. I feel that issue was glossed over at the July meeting.

At the Joint Program Office meeting the other night neighbors mentioned they found antique medicine bottles in their yards. Given the fact that to my knowledge the military has not been able to come up with the records, you've got to find a way, get the technical equipment -- I'm not satisfied with the equipment that's been used thus far to test the soil.

And there's been no water testing for radiologicals. I believe that there should be a several mile radius that should be tested. You need to be able to test for the presence of radiologicals deep within the soil.

I haven't heard anything about -- tonight about thermal treatment of the soil. I don't -- I'm not convinced that all alternatives have been explored adequately.

The air quality monitoring must be done in the neighborhoods or at the perimeter of the base.

I still have more questions about soil vapor extraction and other things so absolutely you need more public information sessions. Thank you.

MS. MUSGRAVE: Could we ask to clarify a question?

MR. KARSON: Yes, you may. Thank you for your comments. We have a question coming to you, I think, before you go, okay.

MS. MUSGRAVE: This is Vanessa Musgrave. I am with the Air Force clean up program. And I just wanted to ask you a clarifying question.

You were suggesting that we have some other informational meetings, kind of break it up. I was wondering if you could give us some more specific idea of what you meant by that and kind of some of the ideas you had on that.

MS. JUDGE: Well, I was at the July meeting and there was a -- I had been to other meetings on other source sites. And I just thought it was really odd that they -- that they -- I don't know who originated the idea, but that you break us up into small study groups and we go from table to table. And everyone in attendance that night agreed that we stay together, because I like to hear what my neighbors are asking as well. It just -- things aren't adding up for me.

I, you know, I don't want to accuse anybody. I really don't want you to take me the wrong way, but when I walked out of July meeting I was suspicious. I felt that an attempt had been made to really gloss over this site and that's how I feel.

MR. KARSON: One more.

MS. JUDGE: Did I answer the question?

MR. KARSON: I'm not sure. I think Vanessa was asking you --

MS. JUDGE: The joint program office.

MR. KARSON: You mentioned there was a lot of information that was presented and you made the comment that we were we should break it up. There was too much at one time. Is that what you meant?

MS. JUDGE: Yeah, I think -- I'm not being critical of your -- I mean, it's a nice slide presentation, but it's an enormous and complex site. And it was just slide after slide of I mean you start to become numb to it.

You hear potential human cancer risk and just comparing it with other sites that I sat in on it just seemed, yeah, too complex of a site to have just the one session.

I wish I had a solution exactly how you would break it up. Maybe one specific meeting. I have a lot of questions about the missiles and if they have been accounted for. I don't know if I'm on the record right now.

MR. KARSON: Yes.

MS. JUDGE: I don't want to have do this again. Again, I felt that issue was glossed over in July. And there needs to be more open discussion and public meeting on the potential for radiologicals unless -- unless the military has found the records. Have all the missiles been accounted for? See, you can't answer my questions right now, right?

MR. KARSON: That's right.

MS. JUDGE: Or correct me if I'm wrong, but in July the gentleman from Oakridge Labs told us that -- he showed us the equipment that they use and they just tested in the facility itself. And I'm not -- I don't feel that that was extensive enough. I think we need more technologically advanced equipment and a much larger study area. Thanks.

MR. KARSON: Thank you. Anyone else wish to give oral testimony tonight on the proposed plan for CS-10 and FS-24?

MR. SULLIVAN: My name is Annie Sullivan. I live on Pebble Path in Forestdale. The words to me "future scenario" and "potential cancer risks" seem -- I don't know, kind of vague.

It almost implies that there's no current risk. And that seems a little odd to me.

The other thing, I'm not a chemist so I'm not quite sure that -- I didn't really get an answer that I understood, but as the asphalt batching on the roads breaks down, I'm just curious where the contaminants go.

I understand they have been adhered to the asphalt or contained somehow, but as they break down over the course of the years and I understand that they're underneath the level of other asphalt that's not contaminated, but does that ever break down? And if it does, where does it go?

MR. KARSON: Thank you. Further comments

on the proposed plan? Anyone else wishing to give oral testimony? Yes, sir.

MR. DRUM: Again, Daniel Drum from Blackthorn Path, Forestdale. I'm concerned that this pollution site has continued to exist as long as it has.

And responding to the previous person's comment that they wanted to extend the informational meetings and comment period, I would like to see this clean up plan go ahead as quickly as is reasonably possible with all the protections in place.

If people need more information, I'm sure that the office on the base would be glad to provide it for them. And they can -- I'm sure it's open most of the time. And they can go over and receive that information.

But I would like to see this clean up plan go ahead and so that we can get this area cleaned up and clean up our neighborhood. Thank you.

MR. KARSON: Thank you. Further comment?

MR. FEIGENBAUM: I'm Joel Feinenbaum from Sandwich a member of the Plume Management Team.

I had thought that the comments and the discussion that was held at the last JPAC meeting was going to be a part of the official record. And we had discussed that. And it's my understanding that AFCEE agreed to it that there was taping of that and a verbatim transcript is produced.

So I would like to request that that be added to the official record. We shouldn't have to be making comments over and over again in different forums all the time.

I hope that there is an extension of the comment period, because in my estimation there are too many unanswered questions in the proposed plan. And in fact the proposed plan as it has been distributed is really not a plan at all. And I'll try to elaborate on that.

The CS-10 site has resulted in one of the worst plumes probably on the continent. And it is certainly one of the most dangerous sites that there is on the base. And furthermore, it's a site that's in extremely close proximity to residential neighborhoods.

It has a large variety of toxic substances. Solvents, PCB's, pesticides. And the possibility of radioactive substances from the BOMARC missiles has not been fully explored at this point. And that is one of the reasons why no comment is possible.

The proposed plan doesn't address at all the methods of protecting the community from the results of the soil excavation.

It just says that this is going to happen but there is no outline of the protections and the monitoring that will occur. And that has to be extremely detailed in order for it to be a plan at all. And it's not included in any kind of detail. It's almost as if you didn't care.

Given the amount of specificity that's in here, I certainly wouldn't want to be raising my children in such proximity to where you're going to do the excavation of these dangerous substances.

There's also been no comprehensive risk assessment in terms of a full analysis of the possibility of air pollution.

In fact, there's been a lot of disinformation that AFCEE has put out. For example, one of your officers today just this evening discussed the question of prevailing winds as if people are so foolish to think that the prevailing winds are the only winds that blow. It's just a question of which is the average direction of the winds, but the winds certainly blow in 360 degrees during any relatively small interval of time.

And in fact, when the winds are blowing from the prevailing direction they're actually maybe more helpful and less harmful than when they're not blowing from the prevailing direction because the wind velocity is greater in the prevailing direction and the stuff is cleared out of there faster.

But we have a diurnal cycle on the Cape that's a result of interacting seabreeze fronts that tends I think to keep material over the Cape and around the Cape.

And again none of this has been truly analyzed in a comprehensive risk assessment taking into account not only the effects of this particular excavation at CS-10 but all the possible excavations that were alluded to that have been threatened throughout this very large base.

To get to another objection is even without conceding that your soil handling has been discussed in a satisfactory way, even getting to the next step it's very hard to see why an operating thermal treatment plant which was at FTA-1, which we had long discussion about and finally came to some conclusions concerning public acceptability and functioned for years apparently in a fairly good way, and it burned down about a year ago. It was rebuilt and then it was torn down.

It seems to me like it's really poor planning when you knew you had all these soil removal operations to have gotten rid of the FTA soil treatment plant.

Incidentally, the soil handling apart from the treatment operation itself, the soil handling at FTA-1 was pretty questionable. There were large piles of soil, contaminated soil that were left exposed to the elements for periods of time. You know, there were even pictures of it in the Cape Cod Times. And that was under AFCEE's watch. So that doesn't lead us to have a great deal of confidence in your soil handling abilities or the care that you take with it.

There has been in a more detailed questioning no analysis has been shown of what kind of volatilization will take place during the actual soil batching process itself.

And since these are very dangerous substances, and the batching is by definition a mixing process, there's some concern that the batching will indeed cause material to enter the air that otherwise wouldn't.

And finally without conceding that either the other two points, the treatment operation or the excavation operation, is safe, I would still question and especially in view of the fact that you're threatening to do this at many other sites as well, I question the huge amount of toxics that will be permanently enshrined in the asphalt at the base.

And we're not just looking at the results of the first year or five years or 10 years. We're looking permanently and at the cumulative effects of having so much toxic material that is essentially volatile locked up in the asphalt.

And as was mentioned earlier, everybody knows that asphalt crumbles and degrades. And at that point it would appear that this material -- there would be a possibility that it would continue to volatilize.

MR. KARSON: Thank you. Any further comments to be given on the proposed plan for CS-10 and FS-24?

(No response.)

MR. KARSON: I would ask again if anyone wishes to give oral testimony on the proposed plan? (No response.)

MR. KARSON: Okay. I'd like to remind people to please sign in on the sign-in sheets before you exit this evening's meeting so that we have your name as part of the official attendee listing for the meeting and hearing.

And if there are no further comments, I'll ask for the last time.

(No response.)

MR. KARSON: Okay. Then I shall now close the official record for oral testimony on the proposed plan for CS-10 and FS-24.

Please note that you can still provide written comments to us, to AFCEE through the 14th of October to our office. And we'll be around for awhile after this meeting.

And I thank you all for coming. Have a good evening. Good night.

(Whereupon the deposition concluded at 8:16 p.m.)

C E R T I F I C A T E

I, MARY E. PHILLIPS, Registered Professional Reporter, do hereby certify that the foregoing transcript, pages 2 through 25 inclusive, was taken by me stenographically and thereafter under my direction was reduced to typewriting and is a true record of the testimony of the proceedings to the best of my ability.

Dated at Bourne, Massachusetts, this 10th day of October, 1998.

Mary E. Phillips

MARY E. PHILLIPS, RPR

APPENDIX E— DECLARATION OF STATE CONCURRENCE

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS
DEPARTMENT OF ENVIRONMENTAL PROTECTION
20 RIVERSIDE DRIVE, LAKEVILLE, MA 02347 508-946-2700

ARGEO PAUL CELLUCCI
Governor

JANE SWIFT
Lieutenant Governor

BOB DURAND
Secretary

LAUREN A. LISS
Commissioner

July 27, 1999

James F. Snyder, Program Manager
HQ AFCEE/MMR
East Inner Road, Box 41
Otis ANG Base, Massachusetts 02542

RE: BOURNE--BWSC--4-0037
Massachusetts Military Reservation, **CS-10/FS-24, Source Areas, Record of Decision, Concurrence**

Dear Mr. Snyder:

The Department of Environmental Protection (the "Department"), has reviewed a document titled "**RECORD OF DECISION, AREA OF CONTAMINATION CS-10/FS-24 SOURCE AREAS, FINAL**" (the ROD) dated July 1999 and prepared by HAZWRAP of Oak Ridge, Tennessee, for the Air Force Center for Environmental Excellence (AFCEE).

Area of contamination (AOC) CS-10/FS-24 is located adjacent to the eastern boundary of the Massachusetts Military Reservation (the MMR), immediately north of the MMR Sandwich Gate on Greenway Road. The AOC is the former Boeing-Michigan Aeronautical Research Center site and occupies approximately 38 acres. Approximately 3,400 cubic yards of contaminated soil will be excavated from AOC CS-10/FS-24. While most contaminated soils will be recycled at an asphalt batching plant at the MMR, be advised that some soils will have to be disposed of at subtitle C facility licensed pursuant to the Resource Conservation and Recovery Act (RCRA) if contaminants exceed Department permitted soil recycling levels.

The Department concurs with the ROD. The concurrence for this ROD is based upon representations made to the Department by the AFCEE and assumes that all information provided is substantially complete and accurate. Without limitation, if the Department determines that any material omissions or misstatements exist, if new information becomes available, or if conditions at the AOC change, resulting in potential or actual human exposure or threats to the environment, the Department reserves its authority under M.G.L. c. 21E, and the Massachusetts Contingency Plan, 310 CMR 40.000 et seq., and any other applicable law or regulation to require further response actions.

Please incorporate this letter into the Administrative Record for AOC CS-10/FS-24. The Department looks forward to working with you to expedite the cleanup of this site. If you have any questions regarding this letter, please contact Leonard J. Pinaud at (508) 946-2871.

Sincerely,

Paul Taurasi, P.E., Regional Director

P/LP/HC/mw
cs10fs24apv.doc

cc: DEP-SERO
ATTN: Mildred Garcia-Surette, Deputy Regional Director
Leonard J. Pinaud, Chief, Federal Facilities Remediation Section

Distributions: SERO
SMB
Plume Containment Team
Public Information Team
Long Range Water Supply PAT
Boards of Selectmen
Boards of Health

Intentional Blank Page

APPENDIX F— ASPHALT BATCHING FACT SHEET

Intentional Blank Page

MMR MASSACHUSETTS MILITARY RESERVATION

Installation Restoration Program

Fact Sheet #98-16 **October, 1998**

Cold Mix Asphalt Batching

A fact sheet providing information about one potential technology for treating contaminated soil at the MMR.

The purpose of this fact sheet is to describe cold asphalt batching – a technology that has been used in the past and may be used in the future to treat contaminated soil at several sites on the Massachusetts Military Reservation (MMR).

This fact sheet will provide background information in an effort to help people gather information and develop informed opinions about the use of the technology at MMR.

Words that appear in *italics* are defined in the glossary at the end of this fact sheet.

DESCRIPTION OF THE TECHNOLOGY

Asphalt batching is a recycling technology in which contaminated soil is incorporated into asphalt mixes as a partial substitute for stone aggregate. It is approved by federal and state regulatory agencies as a remedial technology. The end product is asphalt paving material that, by Resource Conservation and Recovery Act *(RCRA)* standards, can be used safely as an asphalt base or sub-base for roads or parking areas. This technology has been used successfully in New England, New York, New Jersey, and in other states.

Two types of asphalt batching can be used: cold mix and hot mix. Cold mix asphalt batching is a process whereby contaminated soils are coated with an asphaltic *emulsion* in a mobile treatment unit (MTU) at *ambient temperature*. The MTU is known in the industry as a pugmill. The end product is called cold mix. It is usually used as a base under asphalt pavements. The term cold mix is derived from the temperature of the treated material as well as the absence of heat for the emulsion mixing process.

Cold mix is the type of asphalt batch which is currently being proposed at some sites at MMR.

For those companies provident cold mix asphalt batching technology, the emulsion used in this process is patented and is specially designed for this use. It is water based and composed of particles of asphalt dept in suspension by emulsifying agents such as dishwashing liquids. In addition, it contains no hazardous materials. The asphalt in the emulsion binds to the contaminated soil. Tests of cured aggregate material that was stockpiled document that there is no chemical leaching from the asphalt product. The end product is a recycled material with appreciable market value

TECHNOLOGY ANALYSES

Advantages: The principal advantages of cold mix asphalt batching are:

- It keeps contaminated soil out of landfills;
- It minimizes contaminant *volatilization;*
- The final product is a beneficially useful material;
- Speed of treatment (up to 1,000 tons/day);
- Price is cost competitive;
- It minimizes movement of contaminated soils, and associated VOCs and particulate emissions with on-site treatment.

Disadvantages:

- Stockpiled material awaiting treatment must be covered;

PRODUCT USE

Hundreds of thousands of tons of contaminated soil at hundreds of sites have been treated nationwide using on-site cold mix asphalt batching. On-site cold mix asphalt batching was permitted by the MADEP and USEPA and used successfully at the MMR for treating over 6,000 tons of contaminated soils associated with the *Drainage Structure Removal Program* (DSRP) in 1995-1996. Asphalt batching products with similar structural characteristics to a pure asphalt aggregate have been used on major roads throughout Massachusetts.

ASPHALT BATCHING PROCESS

Cold mix asphalt batching is regulated by the MADEP as a recycling/ treatment process.

Contaminated soils will be tested prior to the batching to meet Massachusetts soil recycling criteria (see the following table). Soils not meeting the criteria will be transported to a licensed hazardous waste treatment facility. In addition, soils will be examined to determine their suitability for asphalt batching.

MADEP Policy Document #94-400 (listed in Bibliography) lists maximum concentrations of contaminants in soil that can be used in asphalt batching. The ratio of asphaltic emulsion to contaminated soils will be determined with bench-scale testing. With fine grain soil, a higher percentage of emulsion is required to coat the particles. Occasionally, the soil may be pretreated prior to asphalt batching to stabilize *inorganic* material in the soil. For example, soils with potentially leachable concentrations of lead can be pretreated and stabilized using blends of cement and fly ash. Licensed vendors must receive authorization to use their proprietary fixatives or asphalt emulsifiers from the MADEP.

When soil with relatively low concentrations of volatile organic contaminants (VOCs) is processed, the most conservative modeling estimates show that VOCs normally do not exceed action levels requiring treatment or a MADEP air permit. Movement of soil may cause some particulates to become airborne in the presence of wind. This effect is minimized by (1) lining and covering the excavated soil with polyethylene until it is processed, (2 continuously monitoring the perimeter of the treatment are for excess dust during treatment, and (3) wetting down the soil with water.

The final asphalt product is tested to determine whether it will leach contaminants after during. Its structural stability will also be tested using the federal and/or state highway standards. At the MMR, the processed asphalt material will be immediately used as a sub-base at a parking lot or a road. A minimum of two inches of fine asphalt, free of contaminated soil, will be placed on the top of this sub-base as the wear surface. If the asphalt product should fail any leaching tests, then it will be retreated in the MTU or disposed of off-site in accordance with appropriate regulations.

Massachusetts Soil Recycling Facility Summary Levels[a]

Contaminant	Cold Mix Emulsion Plant mg/kg
Total Arsenic (As)	30
Total Cadmium (Cd)	30
Total Chromium (Cr)	500
Total Mercury (Hg)	10
Total Lead (Pb)	1,000
Total VOCs (dry weight)	30 to 1,800[b]
Total Petroleum Hydrocarbons	5,000 to 60,000[c]
Total PCBs	<2
Total Halogenated Volatile Organic Compounds	5
Listed or Characteristic Hazardous Waste (TCLP[d])	None

Notes: Concentrations of other contaminants, not listed in this table, must meet MADEP S-1/GW-1 standards.

[a] Contaminant levels presented in the table are a summary of allowable contaminant levels in soil recycling permits issued by the DEP's Division of Hazardous Waste as of April 1994. For a complete listing of allowable contaminant levels for a specific facility please consult the applicable facility permit.

[b] and [c] Each permitted VOC level is process specific and permitted levels should be verified with the facility's individual soil recycling permit.

[d] TCLP testing should be performed for metals or organic compounds when the total concentrations in the soil are above the theoretical levels at which the TCLP criteria may be met or exceeded.

RISK ASSESSMENT

Potential risks associated with cold mix asphalt batching are evaluated by examining:

- Contaminants processed and concentrations of the contaminants,
- Materials used in the process,
- Potential pathway of the contaminants to human and ecological receptors, and
- Potential exposure of the contaminants to receptors.

Potential exposure to contaminants through direct contact during asphalt batching processes may occur during operation and maintenance of the plant. Workers at the site are properly trained and provided with necessary tools for protection to comply with Occupational Safety and Health Administration (OSHA) requirements.

The final product, an asphalt aggregate, undergoes leachability testing using EPA's *Toxicity Characteristic Leaching Procedure (TCLP)* to ensure the contaminants are bound to the asphalt emulsion and will not leach in the future. The end use of the product will depend on its structural integrity.

CONTINGENCY MEASURES

Cold mix asphalt batching relies on electrical power. If power to the asphalt batching process stops, stockpiles of the contaminated soil ready for processing will be covered until power is restored, in order to minimize dust/VOC emissions. The MMR and local fire department will be briefed on the asphalt batching process/ equipment prior to the commencement of operations.

Any material that does not meet specifications for use as an asphalt aggregate material will be disposed of in accordance with proper local, state and federal regulations.

COMMUNITY INVOLVEMENT

Public involvement during the decision-making period is critical to selecting an alternative that not only cleans up the contaminated soil and meets regulatory requirements, but also is acceptable to the affected communities. Community involvement activities associated with plans to use asphalt batching to cleanup source areas include public meetings, public hearings and comment periods on the proposed plans.

Asphalt batching may be considered at soil cleanup sites at MMR. Contact the Installation Restoration Program Community Involvement office at (508) 968-4678 for site-specific information and other community involvement opportunities.

BIBLIOGRAPHY

D.W. Malone, Ph.D. et.al., "Current Knowledge Concerning Health Aspects of Asphalt Cement" National Asphalt Pavement Association, Dec, 1985.

The Asphalt Institute. "Determining the Dispersion of Asphalt Emissions.: Maryland: The Asphalt Institute, 1976

Environmental Protection Agency. Engineering Bulletin, "Solidification/Stabilization of Organics and Inorganics. "EPA/540/S-92/015, May 1993

Massachusetts Department of Environmental Protection "Interim Remediation Waste Management Policy for Petroleum Contaminated Soils: #WSC-94-400, April, 1994. Available on DEP Web page at:
www.state.ma.us/dep/bwsc/finalpol.html

Knowlton, R.C. and M.F. Conway, P.E., "Contaminated Soils Recycling Utilizing On-Site Asphalt Emulsion Stabilization", Proceedings of nation Conference on Minimization & Recycling of Industrial & Hazardous Waste '92. Hazardous Material Control Resources Institute, Maryland: 1992.

GLOSSARY

Ambient temperature	Standard temperature without heating or cooling
Cold mix	Chemically bonding contaminated soils without heat
Drainage Structure Removal Program	A comprehensive program to identify, characterize, and remove underground drainage structures, sumps, and associated soils at various sites across MMR.
Emulsion (asphalt emulsion)	A combination of asphalt cement and surfactants (e.g. dishwashing liquids, or other proprietary structured or complex fluid) that is used to stabilize contaminants in soil
Inorganic	Material not containing the element carbon (e.g. metals such as iron)
RCRA	Federal waste management laws, Resource Conservation and Recovery Act
TCLP	Testing procedure to determine if certain levels of hazardous materials leach from waste or processed wastes, Toxicity Characteristic Leaching Procedure
Volatilization	Transfer of a chemical from liquid to vapor; evaporation

For more information, please contact

Vanessa Musgrave, AFCEE Community Involvement Manger, (508) 968-4678

Jim Murphy, EPA Community Involvement, (617) 565-3392

Ellie Grillo, MADEP Community Involvement, (508) 946-2866

APPENDIX G— COST BACKUP FOR DETAILED ANALYSIS FOR ALTERNATIVES

Intentional Blank Page

Table 1a. Revised Capital Costs CS-10/FS-24 SOU
Massachusetts Military Reservation
Alternative 2: Limited Action

Item No.	Description	Unit	Estimated Quantity	Unit Price				Total Cost	Assumption and Basis for Cost Estimates
				Material	Labor	Equipment	Total		
1	**Administrative controls (deed** restrictions, zoning, etc.)	LS	1				$25,000	$25,000	
2	**Access controls (fencing)**	LS	2280	$16.00			$16	$36,480	Applies to Details D, E, and F that are outside the existing perimeter fence at the Base
	SUBTOTAL							**$61,480**	
	Cost adjustments								
	Project contingency		5%					$3,074	
	TOTAL CAPITOL COSTS							**$64,554**	

LS – lump sum.

Table 1b. Revised Estimated Operation and Maintenance Costs for Alternative 2

1. Direct Costs	Unit	Quantity	Unit Cost	Cost	Years	Present Worth
Fence repair and maintenance	LS[a]	1	$2,000	$2,000	30	$60,000
Site reviews[b]	LS	1	$10,000	$10,000	30	$300,000
Subtotal						$360,000
2. Indirect Costs						
Supervision, inspection, and overhead (3%)						$9,000
Contractor bonds (4%)						$12,000
Contractor profit (30%)						$90,000
Contingency (25%)						$75,000
TOTAL INDIRECT COSTS						$186,000
TOTAL DIRECT COSTS						$360,000
TOTAL O&M COSTS ALTERNATIVE NO. 1 (+50%, -30%)						$546,000

[a] LS – lump sum.
[b] Includes sampling program and report preparation.

Table 2a. Revised Capital Costs for CS-10/FS-24 SOU
Massachusetts Military Reservation
Alternative 3: Excavation and On-site Asphalt Batching with Thermally Enhanced Soil Vapor Extraction/Environmental Monitoring

Item No.	Description	Unit	Estimated Quantity	Unit Price				Total Cost	Assumption and Basis for Cost Estimates
				Material	Labor	Equipment	Total		
1	**Mobilization**								
1a	Mobilize contractor equipment	Day	1				$5,000	$5,000	
1b	Establish temporary facilities (water, sanitary, telephone)	LS	1				$5,000	$5,000	
1c	Health and safety/security	LS	1				$5,000	$5,000	
2	**Contractor administration, project management, and miscellaneous work**	LS	1				$10,000	$10,000	
3	**Site work and excavation-related activities**								
3a	Construct decontamination pad and secondary containment facilities for excavated soil	LS	1	$3,450.00	$7,500.00	$3,015.00	$13,965	$13,965	Two containment berms and a decontamination pad
3b	Clearing (bulldozer)	Acre	1	$0.00	$1,800.00	$910.00	$2,710	$2,710	Clearing with bulldozer, light; assumes on-site disposal
3c	Erosion protection (silt fence)	LF	500	$2.70	$0.30	$0.00	$3	$1,500	500 ft of 4-ft polypropylene mesh fence
3e	Install gravel access roads	CY	250	$13.80	$0.91	$1.31	$16	$4,005	3/4-in. crushed stone, 6-in. deep
3f	Pump and transport surface water from eastern impoundment to Base wastewater treatment plant (Detail F)	Day	1	$0.00	$960.00	$2,000.00	$2,960	$2,960	Assumes use of two 10,000-gal vacuum trucks
3g	Excavate, remove, and dispose of underground storage tank TS-1 and associated piping system (Detail C)	LS	1	$750.00	$4,800.00	$1,500.00	$7,050	$7,050	Excavate, clean, and load onto trailer; 3,000- to 5,000-gal tank
3h	Haul tank to certified salvage dump	Each	1	$0.00	$480.00	$400.00	$880	$880	100 miles round-trip
3i	Excavate and load contaminated soils onto 6-cy dump trucks for transport to central stockpile area (all details)	CY	~3,400	$0.00	$1.85	$1.50	$3	$11,390	Backhoe, hydraulic crawler, 1-cy capacity; includes 15% addition for loading
3j	Transport contaminated soils to designated stockpile area	CY	~3,400	$0.00	$3.66	$1.06	$4.72	$16,048	Hauling, 6-cy dump truck; 1-mile round-trip (assumes soils can be stockpiled adjacent to site for processing)

Table 2a (continued)

Item No.	Description	Unit	Estimated Quantity	Unit Price				Total Cost	Assumption and Basis for Cost Estimates
				Material	Labor	Equipment	Total		
3k	Backfill excavation with clean fill using bulldozer	CY	~3,400	$0.00	$1.85	$1.50	$3	$11,390	Bulldozer (75 horsepower), 50-ft haul common borrow
3l	Backfill (common borrow)	CY	~3,400	$10.00	$0.00	$0.00	$10	$34,000	Borrow, common
3m	Compact fill with vibrating plate—walk behind	CY	~3,400	$0.00	$1.79	$1.42	$3	$10,914	12-in lifts; 18-in.-wide compactor; 3 passes
3n	Reestablish wetland area (Detail F)	Acre	1	$3,500.00	$0.00	$0.00	$3,500	$3,500	Wetland mix hydroseed and humic-like soils
30	Sample and analyze excavations to confirm that all contaminated soil has been removed	LS	1				$34,000	$34,000	Assumes the use of on-site mobile laboratory for 30-day period analyzing samples for volatile organic compounds (VOCs) and total petroleum hydrocarbons (TPH) (~150 samples)
4	**Treatment of contaminated soils**								
4a	On-site asphalt batching (Detail A, B, D, E, F, H, and I)	Ton	5100	$0.00	$32.00	$0.00	$32	$163,200	Based on quotation for asphalt batching contractor
4b	Thermally enhanced soil vapor extractin (SVE) (Detail C)	LS	1		-	-	$100,000	$100,000	Based on quotation from SVE contractor
4c	Waste characterization sampling and postprocessing confirmation sampling						$5,750	$5,750	1 sample/100 cy for total metals and polychlorinated biphenyls (PCBs)(4 samples) 1 sample/500 cy for full-suite (postprocessed soil)[b]
5	**Demobilization**								
5a	Seeding contractor-disturbed areas	LS	2				$3,500	$7,000	
5b	Demobilize contractor equipment/facilities							$5,000	

Table 2a (continued)

Item No.	Description	Unit	Estimated Quantity	Unit Price				Total Cost	Assumption and Basis for Cost Estimated
				Material	Labor	Equipment	Total		
6	**Environmental monitoring**								
6a	Geoprobe rental	LS	1	-	-	-	$4,000	$4,000	Based on quote from vendor for 1-week rental of equipment
6b	Subsurface soil sampling analysis	LS	1	-	-	-	$2,400	$2,400	Three samples per site at Details G and H; analyze for VOCs
	SUBTOTAL							**$466,662**	
	Cost adjustments								
	Insurance, warranties, bonds, and permits	10%						$46,666	
	Contractor overhead and profit	30%						$139,999	
	Project contingency	20%						$93,332	
	TOTAL CAPITOL COST							**$7**46,659	

a

cySc uboc yards.

LSSlump sum.

LF-liner feet.

b Full-suite analysis of VOCs, TPH, PCBs, total metals, Toxicity Characteristics Leaching Procedure metals, flashpoint, corrosivity, total organic carbon, and reactivity.

Table 2b. Revised Estimated Operation and Maintenance Costs for Alternative 3

1. Direct Costs	Unit	Quantity	Unit Cost	Cost	Years	Present Worth
Soil vapor extraction (SVE) Detail C	LS[a]	1	$40,000	$40,000	1	$40,000
Site reviews[b]	LS	1	$10,000	$10,000	30	$300,000
Subtotal						$340,000
2. Indirect Costs						
Supervision, inspection, and overhead (3%)						$10,200
Contractor bonds (4%)						$13,600
Contractor profit (30%)						$102,000
Contingency (25%)						$85,000
TOTAL INDIRECT COSTS						$210,800
TOTAL DIRECT COSTS						$340,000
TOTAL O&M ALTERNATIVE NO. 2 (+50%,-30%)						$550,800

a S-lump sum.
b Includes sampling program and report preparation.

Table 3a. Revised Capital Costs for CS-10/FS-24 SOU
Massachusetts Military Reservation
Alternative 4: Excavation and Off-site Asphalt Batching with Thermally Enhanced Soil Vapor Extraction/Environmental Monitoring

Item No.	Description	Unit	Estimated Quantity	Unit Price				Total Cost	Assumption and Basis for Cost Estimates
				Material	Labor	Equipment	Total		
1	**Mobilization**								
1a	Mobilize contractor equipment	Day	1				$5,000	$5,000	
1b	Established temporary facilities (water, sanitary, telephone)	LS	1						
1c	Health and safety/security	LS	1				$5,000	$5,000	
2	**Contractor administration, project management, and miscellaneous work**	LS	1				$10,000	$10,000	
3	**Site work and excavation-related activities.**								
3a	Construction decontamination pad and secondary containment facilities for excavated soil	LS	1	$3,450.00	$7,500.00	$3,015.00	$13,965	$13,965	Two containment berms and a decontamination pad
3b	Clearing (bulldozer)	Acre	1	$0.00	$1,800.00	$910.00	$2,710	$2,710	Clearing with bulldozer, light; assumes on-site disposal
3c	Erosion protection (silt fence)	LF	500	$2.70	$0.30	$0.00	$3	$1,500	500 ft of 4-ft polypropylene mesh fence
3d	Install gravel access roads	CY	250	$13.80	$0.91	$1.31	$16	$4,005	3/4-in. Crushed stone, 6-in. Deep
3e	Pump and transport surface water from eastern impoundment to Base wastewater treatment plant (Detail F)	Day	1	$0.00	$960.00	$2,000.00	$2,960	$2,960	Assumes use of two 10,000-gal vacuum trucks
3f	Excavate, remove, and dispose of underground storage tank TS-1 and associated piping system (Detail C)	LS	1	$750.00	$4,800.00	$1,500.00	$7,050	$7,050	Excavate, clean, and load onto trailer, 3,000- to 5,000-gal tank
3g	Haul tank to certified salvage dump	Each	1	$0.00	$480.00	$400.00	$880	$880	100 miles round-trip
3h	Excavate and load containment soils onto 6-cy dump trucks for transportation to central stockpile area (all details)	CY	~3,400	$0.00	$1.85	$1.50	$3	$11,390	Backhoe, hydraulic crawler, 1-cy capacity, includes 15% addition for loading
3i	Transport contaminated soils to designated stockpile area	CY	~3,400	$0.00	$3.66	$1.06	$4.72	$16,048	Hauling, 6-cy dump truck, 1-mile round-trip (assumes soils can be stockpiled adjacent to site for processing)

Table 3a (continued)

Item No.	Description	Unit	Estimated Quantity	Unit Price Material	Labor	Equipment	Total	Total Cost	Assumptions and Basis for Cost Estimate
3j	Backfill excavations with clean fill using bulldozer	CY	-3,400	$0.00	$1.85	$1.50	$3	$11,390	Bulldozer (75 horsepower); 50-ft haul common borrow
3k	Backfill (common borrow)	CY	-3,400	$10.00	$0.00	$0.00	$10	$34,000	Borrow, common
3l	Compact fill with vibrating plate-walk behind	CY	-3,400	$0.00	$1.79	$1.42	$3	$10,914	12-in. lifts;18-in.-wide compactor; 3 passes
3m	Reestablish wetland area (Detail F)	Acre	1	$3,500.00	$0.00	$0.00	$3,500	$3,500	Wetland mix hydroseed and humic-like soils
3n	Sample and analyze excavations to confirm that all contaminated soil has been removed	LS	1				$34,000	$34,000	Assumes the use of an on-site mobile laboratory for a period of 30 days to analyze for volatile organic compounds (VOCs) and total pertoleum hydrocarbons (TPH) (-150 samples)
4	**Treatment of contaminated soil**								
4a	Transport, deliver, and process contaminated soils at off-site asphalt-batching plant (Details A, B, D, E, F, H, and I)	Ton	5,100	$0.00	$45.00	$0.00	$45	$229,500	Based on quotation from asphalt-batching contractor (assumes none of soils are classified as hazardous waste; processing cost increases 200-300%)
4b	Thermally enhances soil vapor extraction (SVE) (Detail C)	LS	1	-	-	-	$100,000	$100,000	Based on quotation for SVE contractor
4c	Waste characterization sampling and analysis	LS	1				$15,000	$15,000	1 sample/100 cy for VOCs and TPH 1 sample/500 cy for full-suite analysis [a]
5	**Demobilization**								
5a	Seeding contractor-disturbed areas	LS	2	-	-	-	$3,500	$7,000	
5b	Demobilize contractor equipment/facilities							$5,000	

Table 3a (continued)

Item No.	Description	Unit	Estimated Quantity	Unit Price				Total Cost	Assumptions and Basis for Cost Estimate
				Material	Labor	Equipment	Total		
6	**Environmental monitoring**								
6a	Geoprobe rental	LS	1	-	-	-	$4,000	$4,000	Based on quote from vendor for 1-week rental of equipment
6b	Subsurface soil sampling analysis	LS	1	-	-	-	$2,400	$2,400	Three samples per site at Details G and H; analyze for VOCs
	SUBTOTAL							**$542,212**	
	Cost adjustments								
	Insurance, warranties, bonds, and permits		10%					$54,221	
	Contractor overhead and profit		30%					$162,664	
	Project contingency		20%					$108,442	
	TOTAL CAPITOL COST							**$867,539**	

a Full-suite analysis of VOCs, TPH, polychlorinated biphenyls, total metals, Toxicity Characteristic Leaching Procedure metals, flashpoint, corrosivity, total organic carbon, and reactivity.

b CY-cubic yards.
LS-lump sum.
LF-linear feet.

Table 3b. Revised Estimate Operation and maintenance Costs for Alternative 4

1. Direct Costs	Unit	Quantity	Unit Cost	Cost	Years	Present Worth
Soil vapor extraction (SVE) at Detail C	LS[a]	1	$40,000	$40,000	1	$40,000
Site riviews[b]	LS	1	$10,000	$10,000	30	$300,000
Subtotal						$340,000
2. Indirect Costs						
Supervision, inspection, and overhead (3%)						$10,200
contractor bonds (4%)						$13,600
Contractor profit (30%)						$102,000
Contingency (25%)						$85,000
TOTAL INDIRECT COST						$210,000
TOTAL DIRECT COSTS						$340,000
TOTAL O&M COSTS ALTERNATIVE NO.3 (+50%, -30%)						$550,800

[a] LS–lump sum.
[b] Includes sampling program and report preparation.

Table 4a. Revised Capital Costs for CS-10/FS-24 SOU
Massachusetts Military Reservation
Alternative 5: Excavation and Off-site Landfill Disposal/Thermally Enhanced SVE/Environmental Monitoring

Item No.	Description	Unit	Estimated Quantity	Unit Price				Total Cost	Assumptions and Basis for Cost Estimate
				Material	Labor	Equipment	Total		
1	**Mobilization**								
1a	Mobilize contractor equipment	Day	1				$5,000	$5,000	
1b	Establish temporary facilities (water, sanitary, telephone)	LS	1				$5,000	$5,000	
1c	health and safety/security	LS	1				$5,000	$5,000	
2	**Contractor administration, project management, and miscellaneous work**	LS	1				$10,000	$10,000	
3	**Site work and excavation-related activities**								
3a	Construct decontamination pad and secondary containment facilities for excavated soil	LS	1	$3,450.00	$7,500.00	$3,015.00	$13,965	$13,965	Two containment berms and a decontaminatiion pad
3b	Clearing (bulldozer)	Acre	1	$0.00	$1,800.00	$910.00	$2,710	$2,710	Clearing with bulldoxer, light; assumes on-site disposal
3c	Erosion protection (silt fence)	LF	500	$2.70	$0.30	$0.00	$3	$1,500	500 ft to 4-ft polypropylene mesh fence
3d	Install gravel access roads	CY	250	$13.80	$0.91	$1.31	$16	$4,005	3/4-in. Crusheed stone, 6-in. deep
3e	Pump and transport surface water from eastern impoundment to Base wastewater treatment plant (Detail F)	Day	1	$0.00	$960.00	$2,000.00	$2,960	$2,960	Assumes use of two 10,000-gal vacuum trucks
3f	Excavate, remove, and dispose of underground storage tank TS-1 and associated piping system (Detail C	LS	1	$750.00	$4,800.00	$1,500.00	$7,050	$7,050	Excavate, clean, and load onto trailer; 3,000- to 5,000-gal tank
3g	Haul tank to certified salvage dump	Each	1	$0.00	$480.00	$400.00	$880	$880	100 miles round-trup
3h	Excavate and load contaminated soils onto 6-cy dump trucks for transport to central stockpile area (all details)	Cy	-3,400	$0.00	$1.85	$1.50	$3	$11,390	Backhoe; hydraulic crawler, I-cy capacity, includes 15% addition for loading

Table 4a (continued)

Item No.	Description	Unit	Estimated Quantity	Unit Price				Total Costs	Assumption and Basis for Cost Estimates
				Material	Labor	Equipment	Total		
3i	Transport contaminated soils to designated stockpile area	CY	~3,400	$0.00	$3.66	$1.06	$4.72	$16,048	Hauling, 6-cy dump truck, 1-mile round-trip (assumes soils can be stockpiled adjacent to site for processing)
3j	Backfill excavations with clean fill using bulldozer	CY	~3,400	$0.00	$1.85	$1.50	$3	$11,390	Bulldozer (75 horsepower), 50-ft haul; common borrow
3k	Backfill (common borrow)	CY	~3,400	$10.00	$0.00	$0.00	$10	$34,000	Borrow, common
3l	Compact fill with vibrating plate—walk behind	CY	~3,400	$0.00	$1.79	$1.42	$3	$10,914	12-in. lifts; 18-in.-wide compactor; 3 passes
3m	Reestablish wetland are (Detail F)	Acre	1	$3,500.00	$0.00	$0.00	$3,500	$3,500	Wetland mix hydroseed and humic-like soils
3n	Sample and analysis excavations to confirm that all contaminated soil has been removed	LS	1				$34,000	$34,000	Assumes use of on-site mobile laboratory for a period of 30 days to analyze for volatile organic compounds (VOCs) and total petroleum hydrocarbons (TPH) (~150 samples)
4	**Treatment of contaminated soils**								
4a	Transport and deliver contaminated soils to lined landfill in Massachusetts or Rhode Island for use as day cover (Detail A, B, D, E, F, H, and I)	Ton	5,100	$0.00	$26.50	$0.00	$27	$135,150	Based on quotation from asphalt-batching contractor (assumes all soil is within landfill acceptance criteria)
4b	Thermally enhanced soil vapor extraction (SVE) (Detail C)	LS	1	-	-	-	$100,000	$100,000	Based on quotation from SVE contractor
4c	Waste characterization sampling and analysis	LS	1				$14,500	$14,500	1 sample/100 cy for VOCs and TPH 1 sample/500 cy for full-suite analysis[b]
5	**Demobilization**								
5a	Seeding contractor-disturbed areas	LS	2	-	-	-	$3,500	$7,000	
5b	Demobilize contractor equipment/facilities							$5,000	
6	**Environmental monitoring**								

Table 4a (continued)

Item No.	Description	Unit	Estimated Quantity	Unit Price				Total Costs	Assumption and Basis for Cost Estimates
				Material	Labor	Equipment	Total		
6a	Geoprobe rental	LS	1	-	-	-	$4,000	$4,000	Based on quote from vendor for 1-week rental of equipment
6b	Subsurface soil sampling analysis	LS	1				$2,400	$2,400	Three samples per site at Details G and H; analyze for VOCs
	SUBTOTAL							$447,362	
	Cost adjustments								
	Insurance, warranties, bonds, and permits		10%					$44,736	
	Contractor overhead and profit		30%					$134,209	
	Project contingency		20%					$89,472	
	TOTAL CAPITOL COSTS							$715,779	

[a] CY–cubic yards.
LF–linear feet.
LS–lump sum.

[b] Full-suite analysis consists of VOCs, TPH, polychlorinated biphenyls, total metals, Toxicity Characteristic Leaching Procedure metals, flashpoint, corrosivity, total organic carbon, and reactivity.

Table 4b. Revised Estimated Operation and Maintenance Costs for Alternative 5

1. Direct Costs	Unit	Quantity	Unit Costs	Costs	Years	Present Worth
Soil vapor extration (SVE) at Detail C	LS[a]	1	$40,000	$40,000	1	$40,000
Site Reviews[b]	Each	1	$10,000	$10,000	30	$300,000
Subtotal						$340,000
2. Indirect Costs						
Supervision, inspection, and overhead (3%)						$10,200
Contractor bonds (4%)						$13,600
Contractor profit (30%)						$102,000
Contingency profit (25%)						$85,000
TOTAL INDIRECT COSTS						$210,800
TOTAL DIRECT COSTS						$340,000
TOTAL O&M COSTS ALTERNATIVE NO. 4 (+50%,-30%)						$550,800

[a] LS–lump sum.
[b] Includes sampling program and report preparation.

Table 5a. Capital Costs fo CS-10/FS-24 SOU
Massachusetts Military Reservation
Modified Alternative 3a: Excavation, Off-site Asphalt Batching and Off-site Landfill Disposal/Thermally Enhanced SVE/Environmental Monitoring

Item No.	Description	Unit	Estimated Quantity	Unit Price				Total Costs	Assumption and Basis for Cost Estimates
				Material	Labor	Equipment	Total		
1	**Mobilization**								
1a	Mobilize contractor equipment	Day	1				$5,000	$5,000	
1b	Establish temporary facilities (water, sanitary, telephone)	LS	1				$5,000	$5,000	
1c	Health and safety/security	LS	1				$5,000	$5,000	
2	**Contractor administration, project management, and miscellaneous work**	LS	1				$10,000	$10,000	
3	**Site work and excavation-related activities**								
3a	Construct decontamination pad and secondary containment facilities for excavation soil	LS	1	$3,450.00	$7,500.00	$3,015.00	$13,965	$13,965	Two containment berms and a decontamination pad
3b	Clearing (bulldozer)	Acre	1	$0.00	$1,800.00	$910.00	$2,710	$2,710	Clearing with bulldozer, light; assumes on-site disposal
3c	Erosion protection (silt fence)	LF	500	$2.70	$0.30	$0.00	$3	$1,500	500 ft of 4-ft polypropylene mesh fence
3d	Install gravel access roads	CY	250	$13.80	$0.91	$1.31	$16	$4,005	3/4-in. Crushed stone, 6-in. deep
3e	Pump and transport surface water from eastern impoundment to Base wastewater treatment plant (Detail F)	Day	1	$0.00	$960.00	$2,000.00	$2,960	$2,960	Assumes use of two 10,000-gal vacuum trucks
3f	Excavate, remove, and dispose of underground storage tank TS-1 and associated piping system (Detail C)	LS	1	$750.00	$4,800.00	$1,500.00	$7,050	$7,050	Excavate, clean, and load onto trailer, 3,000- to 5,000-gal tank
3g	Haul tank to certified salvage dump	Each	1	$0.00	$480.00	$400.00	$880	$880	100 miles round-trip
3h	Excavate and load contaminated soils onto 6-cy dump trucks for transport to central stockpile area (all details)	CY	~3,400	$0.00	$1.85	$1.50	$3	$11,390	Backhoe; hydraulic crawler, 1-cy capacity, includes 15% addition for loading

Table 5a (continued)

Item No.	Description	Unit	Estimated Quantity	Unit Price				Total Cost	Assumption and Basis for Cost Estimate
				Material	labor	Equipment	Total		
3i	Transport contaminated soils to designed stockpile area	CY	~3,400	$0.00	$3.66	$1.06	$4.72	$16,048	Hauling, 6-cy dump truck, 1-mile round-trip (assumes soils can be stockpiled adjacent to site for processing)
3j	Backfill excavations with clean fill using bulldozer	CY	~3,400	$0.00	$1.85	$1.50	$3	$11,390	Bulldozer (75 horsepower), 50-ft haul; common borrow
3k	Backfill(common borrow)	CY	~3,400	$10.00	$0.00	$0.00	$10	$34,000	Borrow, common
3l	Compact fill with vibrating plate walk behind	CY	~3,400	$0.00	$1.79	$1.42	$3	$10,914	12-in. lifts; 18-in.-wide compactor; 3 passes
3m	Reestablish wetland area (Detail F)	Acre	1	$3,500.00	$0.00	$0.00	$3,500	$3,500	Wetland mix hydroseed and humic-like soils
3n	Sampling and analysis of excavations to confirm that all contaminated soil has been removed	LS	1				$34,000	$34,000	Assumes use of on-site mobile laboratory for a period of 30 days to analyze for volatile organic compounds (VOCs) and total petroleum hydrocarbons (TPH)(~150 samples)
4	**Treatment of contaminated soils**								
4a	Transport and deliver contaminated soils to lined landfill in Massachusetts or Rhode Island for use as day cover (Details A, D, E, F, and H)	Ton	4650	$0.00	$26.50	$0.00	$27	$123,225	Based on quotation from asphalt-batching contractor (assumes all soil is within landfill acceptance criteria)
4b	Transport, deliver, and process contaminated soils as off-site asphalt batching plant (Details B and I)	Ton	450	$0.00	$45.00	$0.00	$45	$20,250	
4c	Thermally enhanced sol vapor extraction (SVE)(Detail C)	LS	1	-	-	-	$100,000	$100,000	Based on quotation from SVE contractor
4d	Waste characterization sampling and analysis	LS	1				$14,500	$14,500	1 sample/100 cy for VOCs and TPH 1 sample/ 500 cy for full-suite analysis [b]
5	**Demobilization**								

Table 5b. Revised Estimated Operation and Maintenance Costs for Modified Alternative 3a

1. Direct Costs	Unit	Quantity	Unit Cost	Cost	Years	Present Worth
Soil vapor extraction (SVE) at Detail C	LS[a]	1	$40,000	$40,000	1	$40,000
Site reviews[b]	each	1	$10,000	$10,000	30	$300,000
Subtotal						$340,000
2. Indirect Costs						
Supervision, inspection, and overhead (3%)						$10,200
Contractor bonds (4%)						$13,600
Contractor profit (30%)						$102,000
Contingency (25%)						$85,000
TOTAL INDIRECT COSTS						$210,800
TOTAL DIRECT COSTS						$340,000
TOTAL O&M COSTS MODIFIED ALTERNATIVE NO. 3a (+50%,-30%)						$550,800

[a] LS–lump sum.
[b] Includes sampling program and report preparation.

Table 5a (continued)

Item No.	Description	Unit	Estimated Quantity	Unit Price				Total Cost	Assumption and Basis for Cost Estimate
				Material	labor	Equipment	Total		
5a	Seeding contractor-disturbed areas	LS	2	-	-	-	$3,500	$7,000	
5b	Demobilize contractor equipment/facilities							$5,000	
6	**Environmental monitoring**								
6a	Geoprobe rental	LS	1	-	-	-	$4,000	$4,000	Based on quote from vendor for 1-week rental of equipment
6b	Subsurface soil sampling analysis	LS	1	-	-	-	$2,400	$2,400	Three samples per site as Details G and H; analyze for VOCs
	SUBTOTAL							**$455,687**	
	Cost adjustments								
	Insurance, warranties, bonds, and permits		10%					$45,569	
	Contractor overhead and profit		30%					$136,706	
	Project Contingency		20%					$91,137	
	TOTAL CAPITOL COSTS							**$729,099**	

[a] CY–cubic yards.
LF–linear feet.
LS–lump sum.

[b] Full-suite analysis consists of VOCs, TPH, polychlorinated biphenyls, total metals, Toxicity Characteristic Leaching Procedure metals, flashpoint, corrosivity, total organic carbon, and reactivity.